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NASA SP-7011 (158)

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY

WITH INDEXES

(Supplement 158)

SEPTEMBER 1976

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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NASA SP-7011 (158)

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 158)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in August 1976 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

Scientific and Technical Information Office
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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* (NASA SP-7011) lists 191 reports, articles and other documents announced during August 1976 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964; since that time, monthly supplements have been issued.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects of biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged in two major sections: *IAA Entries* and *STAR Entries*, in that order. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the slight variation in citation appearances.

Two indexes—subject and personal author—are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1976 Supplements.

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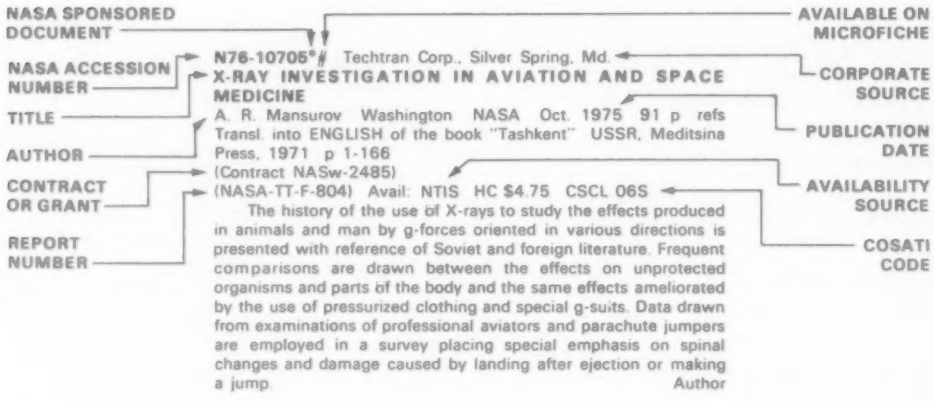
TABLE OF CONTENTS

Page

IAA Entries (A76-10000)..... 201
STAR Entries (N76-10000)..... 219

Subject Index..... I-1
Personal Author Index..... I-21

TYPICAL CITATION AND ABSTRACT FROM *STAR*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N76-10705*# Techtran Corp., Silver Spring, Md.
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TITLE
X-RAY INVESTIGATION IN AVIATION AND SPACE MEDICINE
AUTHOR
A. R. Mansurov Washington NASA Oct. 1975 91 p refs Transl. into ENGLISH of the book "Tashkent" USSR, Meditsina Press, 1971 p 1-166
PUBLICATION DATE
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REPORT NUMBER
(NASA-TT-F-804) Avail: NTIS HC $4.75 CSCL 06S
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The history of the use of X-rays to study the effects produced in animals and man by g-forces oriented in various directions is presented with reference of Soviet and foreign literature. Frequent comparisons are drawn between the effects on unprotected organisms and parts of the body and the same effects ameliorated by the use of pressurized clothing and special g-suits. Data drawn from examinations of professional aviators and parachute jumpers are employed in a survey placing special emphasis on spinal changes and damage caused by landing after ejection or making a jump. Author

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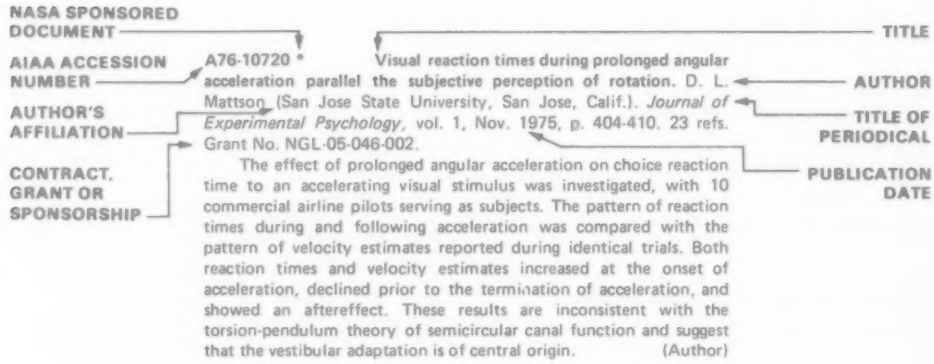
NASA SPONSORED DOCUMENT
TITLE
AIAA ACCESSION NUMBER
A76-10720 * Visual reaction times during prolonged angular acceleration parallel the subjective perception of rotation. D. L.
AUTHOR
AUTHOR'S AFFILIATION
Mattson (San Jose State University, San Jose, Calif.). Journal of
TITLE OF PERIODICAL
Experimental Psychology, vol. 1, Nov. 1975, p. 404-410. 23 refs.
CONTRACT, GRANT OR SPONSORSHIP
Grant No. NGL-05-046-002.
PUBLICATION DATE
The effect of prolonged angular acceleration on choice reaction time to an accelerating visual stimulus was investigated, with 10 commercial airline pilots serving as subjects. The pattern of reaction times during and following acceleration was compared with the pattern of velocity estimates reported during identical trials. Both reaction times and velocity estimates increased at the onset of acceleration, declined prior to the termination of acceleration, and showed an aftereffect. These results are inconsistent with the torsion-pendulum theory of semicircular canal function and suggest that the vestibular adaptation is of central origin. (Author)

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 158)

SEPTEMBER 1976

IAA ENTRIES

A76-31940 **Anatomical configuration of the His bundle and bundle branches in the human heart.** G. K. Massing and T. N. James (Alabama, University, Medical Center, Birmingham, Ala.). *Circulation*, vol. 53, Apr. 1976, p. 609-621. 30 refs. Research supported by the Rast Fund for Medical Research; Grants No. NIH.PH-43-67-1441; No. NIH-1-P17-HL-17667; No. NIH-HL-11310.

A76-31941 * **Noninvasive stress testing - Methodology for elimination of the phonocardiogram.** D. H. Spodick (Lemuel Shattuck Hospital, Boston, Mass.) and V. Q. Lance (Tufts University, Boston, Mass.). *Circulation*, vol. 53, Apr. 1976, p. 673-676. 9 refs. Grant No. NGR-22-012-026.

Measurement by systolic time intervals (STI) of cardiac responses requires extremely careful recording during actual stress test performance. Previous work indicated no significant changes in the pulse transmission time (PTT) during exercise and other challenges. Since external STI depend on the carotid pulse offset by the PTT as an aortic curve equivalent, stable PTT implies that timing of the carotid upstroke and the carotid incisura would respectively track the pre-ejection period and the aortic incisura. In ten subjects, STIs were recorded at supine rest, sitting, standing, during prompt and sustained squatting and during isometric and dynamic exercise. The results demonstrated the tracking of both points. Coefficients of correlation and of determination were uniformly high for all challenges except isometric handgrip (IHG). Since left ventricular ejection time is obtained directly from the pulse curve, with the exception of IHG, STI responses during stress testing can be measured without a phonocardiogram. (Author)

A76-32125 * **On hemispheric differences in evoked potentials to speech stimuli.** R. Galambos, T. S. Smith, C. Schulman-Galambos, H. Osier (California, University, La Jolla, Calif.), and P. Benson. *Electroencephalography and Clinical Neurophysiology*, vol. 39, Sept. 1975, p. 279-283. 6 refs. Grants No. NGR-05-009-198; No. NIH-HD-08694; No. NIH-NS-11735.

Subjects were asked to count the number of times a 'target' sound occurred in lists of speech sounds (pa or ba) or pure tones (250 or 600 c/sec) in which one of the sounds (the 'frequent') appeared about four times as often as the target. The response to both targets and frequents were separately averaged from electrodes at vertex at symmetrical left and right parietal locations. The expected sequence of deflections, including P3 waves with about 350 msec latency, was found in the responses to target stimuli. Very little difference was found between the right and left hemispheric responses to speech or pure tones, either frequent or target. C.K.D.

A76-32166 **Aerospace Medical Association, Annual Scientific Meeting, 47th, Bal Harbour, Fla., May 10-13, 1976, Preprints.** Washington, D.C., Aerospace Medical Association, 1976. 270 p. Members, $10.00; nonmembers, $15.

Papers are presented covering a variety of topics related to aerospace medicine. Among the general categories clinical aerospace nursing, vestibular function, biotechnology, aviation toxicology, accident prevention and survivability, thermal stress, visual perception, and human engineering. Special attention is given to studies of the physiological response to stress in the aerospace environment. C.K.D.

A76-32197 **Sleep in the long-range aviation environment.** F. Hawkins. *Shell Aviation News*, no. 434, 1976, p. 8-16.

The effects of sleep deprivation in long range aviation are considered. Among the adverse effects of cumulative sleep loss are brief lapses of alertness and a reduction in motivation to carry out discriminative functions. The detrimental effects of sleep loss can be minimised by the assignment of tasks that are limited in duration, simple, and self-paced. The tasks should provide knowledge of results to increase interest, and extensive use of short-term memory should be avoided. Chronic sleep loss in flight crews can be avoided by eliminating stimulants and stress-inducing activities prior to sleep and ensuring adequate physical activity. Some experimental evidence indicates that the practice of relaxation techniques can be beneficial. C.K.D.

A76-32223 **The hazards of the radiation of semiconductor laser diodes for the human eye (Zur Gefährlichkeit von Halbleiterlaserdioden-Strahlung für das menschliche Auge).** J. Nier (Robert Bosch GmbH, Stuttgart, West Germany). *Bosch Technische Berichte*, vol. 5, no. 4, 1976, p. 193-199. In German.

Formulas are derived for the calculation of the intensity of the laser radiation which is received by the human eye, taking into account three ranges concerning the distance of the eye from the laser. Formulas for continuous and pulse operation and for an operation with and without lenses are presented. With the aid of two examples it is demonstrated that even semiconductor laser diodes of extremely low power can under ordinary operational conditions provide a radiation intensity which is harmful for the eye. G.R.

A76-32226 **Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975.** Meeting sponsored by the Human Factors Society. Edited by R. N. Hale, R. A. McKnight, and J. R. Moss. Santa Monica, Calif., Human Factors Society, 1975. 509 p. Members, $13.; nonmembers, $18.

The papers contain technical information on human factors in such fields as simulation training, performance measurement and evaluation, law enforcement, and system design and testing. Among the topics covered are: human factors in aging; human factors in architectural design; physical vs psychological simulation in simulator training; translating information requirements into training device fidelity requirements; pilot error and other accident-enabling factors; system-induced errors in CFIT; new product characterization through human factors research; subject/media interactions in learning; decision-making performance measurement for a command and control training system; and man/machine applications of the SAINT system. V.P.

A76-32227 **Training devices - Physical versus psychological simulation.** S. L. Johnson (Calspan Corp., Buffalo, N.Y.). In: Human

factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 24-28. 5 refs. Contract No. F33657-75-C-0021.

Because the engineering aspects of simulation technology are advancing at a rapid pace while the behavioral aspects are lagging behind, a critical look is taken in this paper at the present state of knowledge regarding the definition of requirements for training devices and the research necessary to allow training specialists to make informed decisions. The aim is to achieve better training at the lowest possible cost. V.P.

A76-32228 Simulator training reconsidered - Alternative concepts of transfer. P. W. Caro (Human Resources Research Organization, Alexandria, Va.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p.29-32.

A study showing that flight simulators have been used more effectively by some users than others has given the incentive to reconsider the concepts underlying their design and use. This paper discusses one of these concepts, known as transfer of training, which suggests that all operationally required behaviors and skills must be learned, at least in part, in operational equipment. An alternative concept - transfer of behavior - does not share this unnecessarily restrictive view toward simulation. It suggests that a simulator can serve as a substitute for operational equipment to develop the required behaviors and skills, thus eliminating the need for operational equipment. The differences between the two approaches in the conceptualization of a device training program are discussed. V.P.

A76-32229 Translating information requirements into training device fidelity requirements. A. F. Smode and E. R. Hall (U.S. Navy, Training Analysis and Evaluation Group, Orlando, Fla.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 33-36.

The failure of training equipment to meet training needs is frequently attributed to poor engineering fidelity. Inaccurate or inadequate information requirements may be equally responsible for shortcomings in device design. This paper discusses some aspects of determining the training needs and translating this information into design features. Several approaches are outlined, showing that no level of fidelity is uniformly preferable at the expense of other options. The selection from design alternatives depends on a number of considerations involving engineering capability, instructional advantage, and cost. Several approaches may be incorporated effectively into a complex simulator to achieve some desired instructional capability, however, judgements concerning optimum design approaches must be based on an accumulating training effectiveness data base. V.P.

A76-32233 Methodology for the prediction of complex skill performance. D. M. Dannhaus and C. G. Halcomb (Texas Tech University, Lubbock, Tex.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 140-144. 17 refs.

There has been a long and continuing interest in psychomotor batteries as a viable means to improve behavioral assessment and prediction in a variety of task situations. The present paper describes the conceptual framework and a methodology which contributed to the development of a general purpose psychomotor battery. The tasks which comprise the psychomotor battery at the present time include a velocity estimation task, a four-choice discrimination task, an auditory vigilance task, and a recognition memory task. A description of each task within the battery is presented. Research on the battery has suggested the potential usefulness of the battery as a predictor of complex skill performance. A summary of the research which has been conducted on the psychomotor battery, as well as future research planned, are discussed. (Author)

A76-32234 The effects of visual and proprioceptive feedback on motor learning. J. A. Adams, D. Gopher, and G. Lintern (Illinois, University, Urbana, Ill.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 162-165. 7 refs.

A self paced linear positioning task was used to study the effects of visual and proprioceptive feedback on learning and performance. Subjects were trained with knowledge of results (KR) and tested without it. The analysis of the absolute error scores of the no-KR trials is discussed in this paper. Visual feedback was the more effective source of sensory feedback, but proprioceptive feedback was also effective. An observation that the response did not become independent of sensory feedback as a result of learning, was interpreted as supporting Adams closed loop theory of motor learning in preference to the motor program hypothesis. Other data showed that the presence of visual feedback during learning could inhibit the later effectiveness of proprioceptive feedback. (Author)

A76-32235 * A study of moving base simulation motion cues utilizing washout technique. M. Kirkpatrick, III, N. Shields, Jr., R. Brye (Essex Corp., Huntsville, Ala.), and F. L. Vinz (NASA, Marshall Space Flight Center, Huntsville, Ala.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 173-178. 5 refs. Contract No. NAS8-29914.

The present study was conducted to derive data on non-visual motion thresholds utilizing washout technique, and to develop specific threshold values for use as washout parameters. It describes the results of acceleration detection studies carried out using the NASA MSFC General Purpose Simulator which provides six degree-of-freedom cab motion. A series of experiments was performed to test the hypothesis that constant velocity visual cues might suppress non-visual deceleration sensitivity. The psychophysical method employed was the forced-choice procedure which theoretically yields a pure sensitivity measure. The MSFC General Purpose Simulator was programmed to provide velocity ramps in three axes - pitch, fore-aft translation, and vertical translation. Data were collected with and without a constant velocity visual input. Comparison of the current results with classical data suggested significantly greater sensitivity of the human observer to fore-aft accelerations than has generally been reported, sensitivity tending to depend on motion direction and sign of velocity change. (Author)

A76-32236 Determinants of performance improvement in training under time-sharing conditions. D. Gopher and R. A. North (Illinois, University, Urbana, Ill.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 179-185. 20 refs. Contract No. F44620-70-C-0105.

A one-dimensional compensatory tracking task and a digit-processing, reaction-time task were combined to assess three aspects of training under time-sharing conditions: (1) Manipulation of desired performance levels for dual-task performance comparing performance under single-task demands vs. adjustment to dual-task demands; (2) training under equal and unequal task priorities in time-sharing; (3) repeated sequence of single-dual task presentations. Six groups of 10 subjects participated in the experiment. Larger performance improvements under time-sharing conditions were observed when performance demands were based on dual-task performances than on single-task performances. Training under unequal task priorities revealed that tracking was more sensitive to priority differences than the digit-processing task. Whereas tracking performances improved during single-task training, digit-processing improved only in the time-sharing conditions, suggesting that

provement on the tracking task is in the specific skill of tracking, hile digit-processing improvement results from improved time-aring ability. (Author)

76-32237 The function description inventory as a human ctors tool in evaluating system effectiveness in operational environ-ents. W. R. Helm (U.S. Navy, Naval Air Test Center, Patuxent ver, Md.). In: Human factors in our expanding technology; oceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human ctors Society, 1975, p. 206-208.

Determination of the ultimate suitability of a major air weapon stem through the test and evaluation process includes man-machine aluations of complex components, such as radar, electronic pport measures, communications, etc. In the present paper, a new ethod - the Function Description Inventory (FDI) - is proposed as a ol for providing quantifiable assessment of the effectiveness of the an-machine interface. In addition, the method is an aid toward tegrated subsystem analysis in the total weapon system context. V.P.

A76-32238 Simulator cockpit motion and the transfer of itial flight training. R. S. Jacobs and S. N. Roscoe (Illinois, niversity, Urbana, Ill.). In: Human factors in our expanding chnology; Proceedings of the Nineteenth Annual Meeting, Dallas, ex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 218-226. 20 refs. Contract No. 44620-70-C-0105.

Transfer of flight training from a Singer-Link GAT-2 training imulator, modified to approximate a counterpart Piper Cherokee Arrow airplane, was measured for independent groups of nine light-naive subjects, each trained in one of three simulator cockpit motion conditions: normal washout motion in bank with sustained itch angles, washout banking motion in which the direction of motion relative to that of the simulated airplane was randomly eversed 50% of the time as the cab passed through a wings-level ttitude, and a fixed-base condition. Subjects received predetermined fixed amounts of practice in the simulator on each of 11 flight maneuvers drawn from the Private Pilot flight curriculum. Transfer performance measures, including flight time and trials to FAA performance criteria and total errors made in the process, showed reliable transfer for all groups with differential transfer effects and cost-effectiveness implications depending upon the type of simulator motion. (Author)

A76-32239 Behavioral data in the design of aircrew training devices. B. W. Cream, F. T. Eggemeier, and G. A. Klein (USAF, Human Resources Laboratory, Wright-Patterson AFB, Ohio). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 260-265. 8 refs.

Instruction system development (ISD) behavioral data used for specifying aircraft training requirements are insufficient for the actual specification of equipment design. The methodology proposed in this paper for designing training equipment goes in some ways beyond the collection of behavioral data and avoids the weaknesses of the behavioral data approach. The emphasis is on ensuring that device fidelity requirements are specifically correlated with training requirements. The critical areas discussed are: acquisition of behavioral data; determination of training capabilities; performance measurement; and special requirements for crew coordination training. V.P.

A76-32240 Behavioral taxonomy of undergraduate pilot training tasks and skills. R. P. Meyer, J. I. Laveson, N. S. Weissman (Design Plus, St. Louis, Mo.), and E. E. Eddowes (USAF, Human Resources Laboratory, Williams AFB, Ariz.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 266-270. Contract No. F41609-73-C-0040.

The analysis and specification of fundamental flying abilities which comprise the training objectives of Air Force undergraduate pilot training (UPT) was performed. The taxonomy of UPT tasks and skills is an analytical tool of considerable generality that can be used to aid in understanding the essential requirements of flying training. Surface analyses of fifty UPT maneuvers generated task element descriptions subdivided into a series of cue, mental action, and motor action sequences. The resulting task information was used to identify the pilot skills required to execute the flying tasks described. A set of classification rules organized the skill into a taxonomic cubic concept in which cues, mental actions, and motor actions represented cube faces. The classification rules were validated empirically and used to verify all surface analyses. The required task skills were then organized into a matrix system for simple data retrieval operations. (Author)

A76-32241 SATT revisited - A critical post-examination of the systems approach to training. R. C. Sugarman, S. L. Johnson, W. M. Hinton, Jr. (Calspan Corp., Buffalo, N.Y.), and C. C. Buckenmaier, Jr. (USAF, Systems Command, Wright-Patterson AFB, Ohio). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 271-273. Contract No. F33657-75-C-0021.

To reduce the redundancy of ambiguous terms that plague the training field, the proceduralized ISD (Instruction System Development) method is shown to be an element of the conceptual framework of the SAT (System Approach to Training) method. The strengths and weaknesses of the SAT process are demonstrated by applying SAT to the design of the B-1 aircrew instructional system. SAT is shown to offer the philosophy of system analysis; at the same time it cannot compensate for technically poor decisions, cannot induce creativity and innovation into the decision processes, and cannot provide more than a pointer to the research that is still required to generate a basis for making good decisions. V.P.

A76-32242 SAINT model of a choice reaction time paradigm. R. L. Hann (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio) and G. G. Kuperman (Systems Research Laboratories, Inc., Dayton, Ohio). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 336-341. 9 refs.

The development of simulation techniques which model both the operator and the system processes and parameters is examined as a less time-consuming and expensive alternative to man-in-the-loop real-time simulation. Attention is focused on one of these techniques, known as SAINT (System Analysis of Integrated Networks of Tasks). It is shown how SAINT can be used to model psychological theory and how it can serve as an initial investigation of performance assessment metrics. V.P.

A76-32243 SAINT simulation of a remotely piloted vehicle/drone control facility. D. B. Wortman, S. D. Duket (Pritsker and Associates, Inc., Lafayette, Ind.), and D. J. Seifert (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 342-346. 17 refs. Contract No. F33615-75-C-5012.

SAINT is a modeling and simulation technique that provides the concepts necessary to model systems that contain tasks (discrete elements), state variables (continuous elements), and interactions between them. SAINT has been designed to facilitate the modeling and analysis of complex man-machine systems. This paper describes a SAINT network model of a real-time simulation of a drone control facility (DCF) in which operators monitor and control the flight of simulated remotely piloted vehicles (RPVs) through the use of visual (CRT) displays. (Author)

A76-32244 **Development of a computer simulation model for evaluating DAIS display concepts.** G. G. Kuperman (Systems Research Laboratories, Inc., Dayton, Ohio) and D. J. Seifert (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 347-353. 9 refs.

Systems Analysis of Integrated Networks of Tasks (SAINT) network and computer simulation techniques were applied in support of the Digital Avionics Information System (DAIS) advanced development program. A computer-programmed model was developed to closely parallel Aerospace Medical Research Laboratory's Advanced Cockpit Design Simulator (ACDS) man-in-the-loop experiments with respect to task scenarios, task durations, and control tolerances used. Networks developed for the model represented both multifunction switching and multipurpose display concepts of DAIS and dedicated avionics subsystem display and control concepts of conventional aircraft systems. Exercise of the computer model provided estimates of the nature of primary and secondary task interaction, performance predictions, and validation of the modeling concepts and accuracy within the limits of the available empirical data. (Author)

A76-32245 **Criterion referenced measures of technical proficiency in maintenance activities.** J. P. Foley, Jr. (USAF, Human Resources Laboratory, Wright-Patterson AFB, Ohio). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 375-380. 14 refs.

It has been shown that written tests of theoretical knowledge are an undependable means of evaluating the ability of maintenance personnel to perform job tasks. A model battery of 48 criterion referenced job task performance tests which has been developed to cover all key maintenance activities, such as checkout, align/adjust, remove/replace, trouble-shooting, use of test equipment, and soldering, is described. Factors such as the identification and classification of tasks to be measured, the hierarchical nature of maintenance tasks, and the ease of test administration were taken into consideration. The test battery is intended to be used in training and on-the-job evaluations, and as a means of validating substitute symbolic tests. Graphic and video symbolic tests have been developed and given limited validation. C.K.D.

A76-32246 **Three-dimensional profiles of movements of human body joint centers.** S. Deivanayagam, M. M. Ayoub (Texas Tech University, Lubbock, Tex.), and K. Kennedy (USAF, Wright-Patterson AFB, Ohio). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 394-402. Contract No. F33615-73-C-4073.

Certain results of an experimental investigation on motion profiles, in three-dimensional space for various body landmarks while the hand moves from one location to another are presented here. Grip, wrist, elbow and shoulder joint centers were of primary consideration for this study. A photogrammetric technique was adopted to record the movement and to extract the required information later. Seven subjects participated and 30 movements were performed by each of them under three different seat configurations and six controller locations. This research was initiated for the purpose of developing computer models in aircraft cockpits. (Author)

A76-32247 **Measurement of muscle fatigue using electromyography.** M. M. Ayoub, H. F. Martz (Texas Tech University, Lubbock, Tex.), and C. H. Wu (Texas Instruments, Inc., Dallas, Tex.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 403-414. 13 refs.

This paper summarizes research project which investigated the signal characteristics of muscle action potentials when the muscle is fatigued and evaluated these characteristics as a measure of muscle fatigue. Eight subjects participated in the study under conditions of static and dynamic loading of the biceps muscle. The level of loading varied as a percent of maximum isometric muscle strength. The paper presents a criteria which defines muscle fatigue and discusses predictive models for muscle fatigue using this criteria for both static and dynamic loading. (Author)

A76-32248 **Effects of the menstrual cycle on the performance of complex perceptual psychomotor tasks.** A. G. Baisden and R. S. Gibson (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, Fla.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 415-417. 20 refs.

A76-32249 **Scanning patterns in real-time FLIR displays.** M. J. Krebs (Honeywell, Inc., Minneapolis, Minn.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 418-422.

Scanning behavior was investigated in a target acquisition task using video-taped forward looking infrared (FLIR) imagery. Comparisons in both target acquisition performance and scan patterns were made between trained FLIR operators and college students with no prior exposure to FLIR. For both groups the sequence of fixations and the distribution of fixation densities were different for each scene and dependent on its specific content. Subjects appeared to systematically explore areas within a scene in terms of some estimate of the probability of a target being present. The eye data may reflect group differences of two types. First, the priorities assigned by each group to various areas were apparently different and secondly, the FLIR operators apparently were able to make a 'target, no target' decision more quickly at each fixation as reflected in the typically shorter fixation times. (Author)

A76-32250 * **Design parameters for a stereoptic television system based on direct vision depth perception cues.** N. L. Shields, Jr., M. Kirkpatrick, III (Essex Corp., Huntsville, Ala.), T. B. Malone (Essex Corp., Alexandria, Va.), and C. T. Huggins (NASA, Marshall Space Flight Center, Huntsville, Ala.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 423-427. Contract No. NAS8-30545.

Remotely controlled systems which use television for visual feedback require that depth cues be available to the operator. A number of techniques have been developed to provide stereoptic video. An analysis of parameters of such systems as related to the depth cues of convergence and retinal disparity was carried out. Parameter requirements were determined for the provision of natural and exaggerated stereoptic cues and expressions were developed for range resolution limits based on the retinal disparity threshold. An empirical study was conducted using a stereoptic video system to determine threshold values. (Author)

A76-32251 * **Television systems for remote manipulation.** W. H. Crooks (Perceptronics, Inc., Woodland Hills, Calif.), L. A. Freedman (RCA, Astro-Electronics Div., Princeton, N.J.), and P. P. Coan (NASA, Johnson Space Center, Houston, Tex.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 428-435. 11 refs. Contract No. NAS9-14266.

An analytical and experimental study was conducted to specify a video system for remote manipulation in space. An operator function analysis identified two basic characteristics, work volume

and element relationship, which define four manipulation tasks chosen for examination. A visual function analysis developed a set of elemental scene parameters which grouped the visual dimensions into major areas of influence. Simulation testing was conducted with a four degree-of-freedom motion frame which allowed an operator to perform the manipulation tasks. Four video systems were included in the simulation testing: a black and white and a color monoscopic system, a stereoscopic system, and a black and white two-view system. A sequential experimental plan first provided an overall analysis of the effects of tasks, scene parameters, and video systems. This was followed by a detailed experimental examination of the critical dimensions identified in the first experiment. Results are discussed in terms of a recommended TV system. (Author)

A76-32252 **Aviator performance during day and night terrain flight.** M. A. Lees, K. A. Kimball, L. W. Stone, and M. A. Hofmann (U.S. Army, Aeromedical Research Laboratory, Fort Rucker, Ala.). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 436-440.

Terrain flying both day and night is now an Army Aviation tactical requirement. The present investigation compared terrain flight for Low Level (LL) and Nap-of-the-Earth (NOE) profiles for (1) day flight with the unaided eye, (2) night flight with the unaided eye, and (3) night flight using Night Vision Goggles. Data was acquired through use of the Helicopter In-flight Monitoring System (HIMS). The total set of in-flight measures for LL and NOE were analyzed separately with further analysis on the subsets of pilot control variables, and aircraft status variables. Multiple discriminant analysis techniques were used to determine which measures best discriminated between visual conditions. (Author)

A76-32253 **Simulated helo ground target acquisition under different sun angles and ground textures.** M. Freitag, R. L. Hilgendorf, and R. G. Searle (Martin Marietta Aerospace, Rockville, Md.; USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). In: Human factors in our expanding technology; Proceedings of the Nineteenth Annual Meeting, Dallas, Tex., October 14-16, 1975. Santa Monica, Calif., Human Factors Society, 1975, p. 473-479. 7 refs.

Experiments were conducted to study the effect of sun angle and ground texture on tank target acquisition using a 1:1000 terrain table to simulate pop-up maneuver. A three-by-two factor mixed design was used, representing three levels of sun angle and two levels of terrain location, so that each of three groups of ten subjects was tested under one of three sun angles at both target area locations. It is shown that hillier terrain provides easier detection background for the 0 to 180 deg sun angle than does the smoother terrain. For the hilly portion of the terrain table, the 90 deg sun angle group is characterized by a significantly shorter slant range and requires considerably more search time than the zero or 180 degree sun angle groups. This may be due to the interaction of large amounts and depths of shadows in hilly terrain and the difficulty of acquiring a tank target when its shadow is located at the side of the tank. S.D.

A76-32288 **Physical properties of blood and their influence on blood-flow measurement.** J. P. Woodcock (Bristol General Hospital, Bristol, England). *Reports on Progress in Physics*, vol. 39, Jan. 1976, p. 65-127. 164 refs. Research supported by the Medical Research Council.

The paper discusses the structure and composition of blood, the viscous properties of blood, and the electrical, optical, and thermal properties of blood, and examines how these properties are used in a variety of techniques for measurement of blood flow. The basic features of the current blood flow measurement techniques are then examined. For flow in major vessels, the following techniques are covered: electromagnetic flowmeters, indicator-dilution methods, thermal techniques, resistance thermometry and heated-probe flowmeters, pressure-sensitive techniques, and ultrasonic flowmeters; for flow in organs and tissues, the discussion covers indicator-transport techniques, plethysmography, and thermal methods. The advantages and disadvantages of each particular method are discussed, and a table is provided to aid in the optimum choice of flow measurement method for a particular situation. P.T.H.

A76-32421 **Mineral metabolic adaptation to simulated hypogravics.** H. Saiki, M. Nakaya, Y. Sugita, and M. Kamachi (Jikei University School of Medicine, Tokyo, Japan). In: International Symposium on Space Technology and Science, 11th, Tokyo, Japan, June 30-July 4, 1975, Proceedings. Tokyo, AGNE Publishing, Inc., 1975, p. 881-886. 7 refs.

The levels of excreted K(+) and Na(+) were monitored in rats exposed to prolonged hypodynamics. After an initial decrease during the first week of suspension, K(+) excretion increased to a level close to normal. A higher plateau, indicating adaptation, was attained in the third week. About 4 weeks were required for re-adaptation to normal conditions following 5 weeks' suspension. Na(+) metabolism showed a similar, but slower, pattern of adaptation. The anti-kaliuresis induced by suspension was negated by administration of aldosterone during the prestabilized phase. Administration of tetracycline reduced the level of K(+) excretion in the stabilized phase, an effect which was blocked by administration of aldosterone. The results indicate that a decrease in aldosterone activity in the prestabilized phase followed by an increase in activity during the stabilized phase is characteristic of the process of renal adaptation to hypokinetics. C.K.D.

A76-32474 **Dynamics of two-legged walking. II.** V. V. Beletskii. (*Akademiia Nauk SSSR, Izvestiia, Mekhanika Tverdogo Tela*, July-Aug. 1975, p. 3-13.) *Mechanics of Solids*, vol. 10, no. 4, 1975, p. 1-10. Translation.

Analytical solutions in closed form are obtained for several problems in which a biped system is simulated as a solid with two inertialess legs with many joints suspended at one point. The compensating motions of the body (balancer), the control moments in the leg joints, and the reactions of the suspension are determined from the given trajectory of the suspension point and the trail trajectory. V.P.

A76-32501 **Sweating responses during changes of hypothalamic temperature in the rhesus monkey.** K. A. Smiles, R. S. Elizondo, and C. C. Barney (USAF, Medical Research Laboratory, Wright-Patterson AFB, Ohio; Indiana University, Bloomington, Ind.). *Journal of Applied Physiology*, vol. 40, May 1976, p. 653-657. 11 refs. Grant No. AF-AFOSR-73-2473.

A durable hypothalamic perfusion system which permits independent manipulation of skin and hypothalamic temperature was used to investigate sweating responses during changes in hypothalamic temperature in the rhesus monkey. A linear relation was found between sweat rates on the general body surface and clamped hypothalamic temperature. Changes in skin temperature affected the hypothalamic set-point temperature at which sweating began but did not alter the gain of the hypothalamic temperature-sweat rate relationship. The similarity of this response to that observed in man (Nadel at al., 1971) indicates that the rhesus monkey is a suitable analog for investigating evaporative cooling in man. C.K.D.

A76-32502 **Limiting factors to oxygen transport on Mount Everest.** P. Cerretelli (Milano, Università; CNR, Centro Studi di Fisiologia del Lavoro Muscolare, Milan, Italy). *Journal of Applied Physiology*, vol. 40, May 1976, p. 658-667. 33 refs.

The effect of a suden increase in the inspired oxygen tension on maximum muscular aerobic performance was investigated in 23 healthy males acclimated to an altitude of 5.350-8.848 m above sea level. The maximal oxygen consumption of acclimated individuals breathing pure oxygen at 390 mm Hg or subjected to a rapid descent to an altitude of 2.850 m was sharply reduced in comparison with

unacclimated individuals in spite of the presence of a 40 percent increase in hemoglobin concentration and a limited reduction in maximum cardiac output. This effect is attributed to changes in peripheral circulation, which may involve hindrance of O2 diffusion by the packing of erythrocytes and/or a bypass of arterial blood from the high-resistance working areas of the body to relieve the load on the heart imposed by increased blood viscosity. C.K.D.

A76-32503 **Effect of neck versus chest cooling on responses to work in heat.** E. Shvartz (Tel Aviv University, Tel Aviv, Israel). *Journal of Applied Physiology*, vol. 40, May 1976, p. 668-672. 19 refs.

Six young men performed bench-stepping at a load of 40 W, once at room temperature of 23 C and 3 times in heat (39.5 C dry bulb, 30.3 C wet bulb). Two of the heat exposures included cooling of either the neck or chest by circulating cool water having an inlet temperature of 8.3 C. The heat exchangers for the neck and chest were of equal size and covered 2.2% of the body surface area. Heat exchange between the tubing assemblies and the environment was prevented by proper insulation. Each method of cooling resulted in no change in heart rate, a decrease of 0.5 C in rectal temperature, small and insignificant decreases in skin temperature and 16-22% decreases in sweat rates. Heat removed from the neck and chest equalled 63.1 and 61.9 W/sqm, respectively. This large heat removal and the substantial decreases in rectal temperature and sweat rate as a result of cooling 2.2% of the body surface area were explained in terms of the powerful effect of conductive cooling and the particular regions which were cooled. (Author)

A76-32504 **Autonomic origin of heart rate fluctuations at the onset of muscular exercise.** L. Fagraeus and D. Linnarsson (Kungl. Karolinska Institutet, Stockholm, Sweden). *Journal of Applied Physiology*, vol. 40, May 1976, p. 679-682. 25 refs.

The time courses of the heart rate (HR) changes were studied in six healthy male subjects who performed step changes from rest to light dynamic leg exercise in the sitting position during control, parasympathetic blockage (atropine), beta-adrenergic blockade (propranolol), and during combined blockade with both drugs. During the control and beta-blockade experiments all subjects showed an immediate, rapid increase in HR, reaching a peak value after about 10 s, whereafter an equally rapid transient drop by 10-20 beats/min took place reaching the lowest values about 17 s after the onset of work. HR then again increased to reach a steady-state level within 60-90 s. In the atropine experiments this response pattern was not evident at all, whereas in the experiments with combined blockade it could be distinguished to a small degree. It is concluded that the observed fluctuations of HR at the onset of light dynamic exercise can be explained by a rapid vagal withdrawal, followed by a transient increase in vagal tone. (Author)

A76-32505 **Autonomic thermoregulation in squirrel monkey when behavioral regulation is limited.** E. R. Adair (John B. Pierce Foundation Laboratory; Yale University, New Haven, Conn.). *Journal of Applied Physiology*, vol. 40, May 1976, p. 694-700. 24 refs. Grant No. PHS-ES-00354.

Squirrel monkeys in a cold environment (10, 0, or minus 5 C) learned to partially control their chamber air temperature by pulling a chain for 10-s reinforcements of 30 C air. A maximal response rate of 5/min produced an average air temperature well below their preferred 35 C. Metabolic heat production was elevated 0.3-1.0 W/kg. Preoptic cooling stimulated increased metabolic heat production, with a resultant rise in core temperature. Preoptic warming stimulated reduced heat production and some peripheral vasodilation, resulting in a fall in core temperature. The metabolic response of all animals was directly related to the skin-to-air temperature difference. In most cases the mean skin temperature remained essentially unchanged as a result of a steady behavioral response rate. The study demonstrated that even when behavioral thermoregulation is inefficient, it is generally sustained with maximal vigor over long periods. This behavior is then supplemented by appropriate autonomic adjustments when necessary to achieve full regulation of the body temperature. (Author)

A76-32506 **Closing volumes in man immersed to the neck in water.** K. R. Bondi, J. M. Young, R. M. Bennett, and M. E. Bradley (National Naval Medical Center, Naval Medical Research Institute, Bethesda, Md.). *Journal of Applied Physiology*, vol. 40, May 1976, p. 736-740. 23 refs. Research supported by the Bureau of Medicine and Surgery. BMS Task M4306,02,8012.

Closing volumes (CV), along with residual volume (RV), vital capacity, and expiratory reserve volume (ERV) were determined in 10 subjects in the dry and while immersed to the neck in water. Closing volumes during immersion increased 41.3% over dry values while RV decreased 9.35% and VC decreased 9.94%. The large decrease of 71.3% in ERV resulted in the impingement of closing capacity (CV + RV) on the tidal volume, suggesting that airway closure occurs during tidal ventilation in immersed subjects and may result in impaired gas exchange. When tourniquets were applied to all four limbs during immersion closing volumes increased only 32.1% but increased to 64.3% when they were removed. If engorgement of peribronchial vessels predisposes airways to collapse, a reduction of plasma volume during an extended period of immersion might lessen this possibility. In a series of long term immersion experiments where moderate reductions in plasma volume were observed no correlative changes in closing volume were found. (Author)

A76-32507 **Acclimatization in a hot, humid environment - Energy exchange, body temperature, and sweating.** D. Mitchell, L. C. Senay, C. H. Wyndham, A. J. van Rensburg, G. G. Rogers, and N. B. Strydom (Chamber of Mines of South Africa, Human Sciences Laboratory, Johannesburg, Republic of South Africa; St. Louis University, St. Louis, Mo.). *Journal of Applied Physiology*, vol. 40, May 1976, p. 768-778. 47 refs.

Four young men worked for 4 h/day at 40-50% of their maximum aerobic capacity for 3 days at 25 C dry bulb, 18 C wet bulb and then for 10 consecutive days at 45 C dry bulb, 32 C wet bulb. As a group, the men showed classical acclimatization responses, but there were marked individual differences. A calorimetric analysis revealed that reductions in strain were associated with minor changes in heat balance confined to the first and last hours of exposure. Events occurring within the first 4 days appeared to have little effect on body temperatures. Significant decreases in body temperature took place only when sweat and evaporation rate increased. A 10% increase in evaporation rate was accompanied by a 30% increase in sweat rate and a 200% increase in unevaporated sweat. By the 10th day skin temperature was confined to the level necessary to evaporate sufficient sweat to achieve thermal balance with a fully wet body surface. The efficiency of heat transport within the body did not change with acclimatization. (Author)

A76-32508 **Acclimatization in a hot, humid environment - Cardiovascular adjustments.** C. H. Wyndham, G. G. Rogers, L. C. Senay, and D. Mitchell (Chamber of Mines of South Africa, Human Sciences Laboratory, Johannesburg, Republic of South Africa; St. Louis University, St. Louis, Mo.). *Journal of Applied Physiology*, vol. 40, May 1976, p. 779-785. 17 refs.

Four young men worked for 4 h/day at 40-50% of their maximum aerobic capacity, first for 3 days at 25 C dry bulb, 18 C wet bulb, and then for 10 consecutive days at 45 C dry bulb, 32 C wet bulb. The central circulatory adaptation to work in heat could be divided into four distinct phases: phase I (day 1) was characterized by a progressive fall in stroke volume (SV) during heat exposure but cardiac output (CO) was maintained above control values by high heart rates. Phase II (days 2 and 3) was marked by increases in SV and decreases in heart rate but with little change in CO from phase I. During phase III (days 4-8 of acclimatization), CO increased due to increases in SV. Phase IV (days 6-8) was associated with decreases in rectal and skin temperature toward control levels. SV and HR both decline in this phase so that CO was not elevated greatly above control levels. The results indicated that central circulatory and temperature regulating events are not causally associated in acclimatization. (Author)

A76-32509 **Acclimatization in a hot, humid environment - body fluid adjustments.** L. C. Senay, D. Mitchell, and C. H. Wyndham (Chamber of Mines of South Africa, Human Research Laboratory, Johannesburg, Republic of South Africa; St. Louis University, St. Louis, Mo.). *Journal of Applied Physiology*, vol. 40, May 1976, p. 786-796. 18 refs.

Four trained men worked 4 h/day at 40-50% of their maximum aerobic capacity first for 3 days at 25 C dry bulb, 18 C wet bulb and then for 10 consecutive days at 45 C dry bulb, 32 C wet bulb. Between days 1 and 2 of heat exposure mean total circulating protein (TCP) and plasma volume (PV) increased 11.6% and 9%, respectively. Preexposure TCP and PV increased until day 6 of heat exposure. Of the protein fractions beta-globulins underwent the largest relative increase. During work, movement of protein into and out of the vascular compartment was similar in control and acclimatizing subjects but the latter generally maintained a greater amount of protein and fluid within the vascular volume. The increase in vascular volume was ascribed to transfer of interstitial protein and water to the vascular volume. Regression coefficients indicated significant correlations for changes in plasma volume versus heart rate, stroke volume, and cardiac output during acclimatization. It was concluded that the most critical event in heat acclimatization is the expansion of the plasma volume. (Author)

A76-32510 **Local regulation of collateral ventilation by oxygen and carbon dioxide.** R. J. Traystman, G. K. Batra, and H. A. Menkes (Johns Hopkins University, Baltimore, Md.). *Journal of Applied Physiology*, vol. 40, May 1976, p. 819-823. 20 refs. Grants No. PHS-HL-10342; No. PHS-HL-05453; No. PHS-HL-14153.

The effects of varying local alveolar concentrations of oxygen and CO2 on the mechanics of collateral ventilation were investigated in anesthetized paralyzed dogs. A double-lumen catheter was wedged into a peripheral airway, obstructing a segment of lung. Air, 5% CO2 in air, 10% CO2 in air, 5% O2 in N2, or 5% O2 with 5% CO2 in N2 was infused at a constant flow through one lumen, while pressure was monitored through the other. When the flow was interrupted, the time for the pressure to fall 63% was defined as the time constant for collateral ventilation, Tcoll. When air was replaced by 5% CO2, the resistance to collateral flow, Rcoll (pressure/flow) fell 46.3% and Tcoll fell 41.5%. When the CO2 concentration was increased to 10%, Rcoll fell an additional 9.2% and Tcoll fell an additional 5.1%. When air was replaced by 5% O2 in N2, Rcoll rose 36.6% and Tcoll rose 13.5%. It is suggested that the mechanisms responsible for the observed effects on the mechanics of collateral ventilation may play a significant role in the regulation of ventilation perfusion relationships in the lung. C.K.D.

A76-32511 **Electromechanical stimulator for presenting moving cutaneous stimuli.** L. F. Walsh, R. P. Hantman, and D. L. Blank (New York, State University; U.S. Veterans Administration Hospital, Syracuse, N.Y.). *Journal of Applied Physiology*, vol. 40, May 1976, p. 824-826. 7 refs. NSF Grant No. B-043140X00; Grant No. NIH-GM-11413.

Recent interest in the neural processing of complex cutaneous stimuli such as moving stimuli has necessitated more versatile stimulating devices. This article describes the construction and application of a relatively inexpensive instrument, utilizing equipment readily available in most neurophysiological laboratories, which provides a variety of moving cutaneous stimuli of selected velocities, excursions, and directions. The electronic portion of the instrument consists of a logically controlled variable rate integrator wired to conform to the electrical and mechanical characteristics of a Grass P5 plug-in. This circuitry operates the remainder of the instrument which consists of a P5 driver amplifier used to drive the pen motor mechanism that provides the moving cutaneous stimulus. (Author)

A76-32512 **Fluid-filled blood pressure measurement systems.** J. K.-J. Li, A. G. W. van Brummelen, and A. Noordergraaf (Pennylvania University, Philadelphia, Pa.; Organization of Health Research TNO, Leiden, Netherlands). *Journal of Applied Physiology*, vol. 40, May 1976, p. 839-843. 20 refs. Grant No. NIH-HL-10330.

The performance of catheter-manometer systems for the measurement of pulsatile pressure has been evaluated by both experimental techniques and theoretical considerations, ranging from extreme lumping to application of transmission line theory while employing different configurations in the system's representation. Multiple maxima in amplitude response have been seen using both approaches. The present paper identifies the sources of the differences found and compares the relative merits of various theoretical approaches. It introduces the compliance of the system as a figure of merit and provides a simple first-order approximation formula for evaluation of the quality of a system. Damping and impedance matching to improve the system's frequency response were found to be unnecessary in a very stiff or a very compliant system. (Author)

A76-32622 **Role of the carotid chemoreceptors in the hyperpnea of exercise in the cat.** D. Aggarwal, H. T. Milhorn, Jr., and L. Y. Lee (Mississippi, University, Medical Center, Jackson, Miss.; East Tennessee State University, Johnson City, Tenn.). *Respiration Physiology*, vol. 26, Apr. 1976, p. 147-155. 17 refs.

A76-32623 **Limiting role of stratification in alveolar exchange of oxygen.** F. Adaro (Buenos Aires, Universidad, Buenos Aires, Argentina) and J. Piiper (Max-Planck-Institut für experimentelle Medizin, Göttingen, West Germany). *Respiration Physiology*, vol. 26, Apr. 1976, p. 195-206. 10 refs. Research supported by the Bergbau-Berufsgenossenschaft.

On the basis of a simple lung model the limiting effects of stratification on tidal/alveolar transfer of O2 are calculated using values for diffusive conductance of distal airways previously obtained from analysis of wash-out kinetics of He and SF6. In particular it is shown that the alveolar-capillary transfer of O2 (neglected in a previous study) plays an important role in giving rise to stratificational gradients of O2 in distal airways. For 10-kg dogs breathing hypoxic mixtures the stratificational component of the alveolar-arterial PO2 difference is estimated at about 0.8 torr for resting conditions and at about 3.5 torr for medium level exercise. (Author)

A76-32635 **The perceptual basis of loudness ratio judgments.** B. Schneider (Toronto, University, Toronto, Canada), S. Parker (American University, Washington, D.C.), G. Farrell (Syracuse University, Syracuse, N.Y.), and G. Kanow (Pennsylvania, University, Philadelphia, Pa.). *Perception and Psychophysics*, vol. 19, no. 4, Apr. 1976, p. 309-320. 26 refs. Research supported by the National Research Council of Canada; NSF Grant No. GB-36211.

An experiment was conducted in which five human subjects with normal hearing were required to estimate loudness ratios for 45 pairs of tones produced from ten 1200-Hz tones differing only in intensity. Another experiment was carried out in which eight subjects were required to directly compare two pairs of tones chosen from among the set of 45 pairs of tones and to indicate which pair of tones had the greater loudness ratio. From these binary comparisons, a rank order of loudness differences for the tones was constructed. A nonmetric analysis of this rank order indicated that loudness grew as the 0.26 power of sound pressure. It is shown that both magnitude estimates of loudness ratios and direct comparison of loudness ratios are based on loudness intervals or differences among the tones where loudness is a power function of intensity. Torgerson's (1961) conjecture that there is but one comparative perceptual relationship for loudnesses is verified. The results suggest a reconsideration of the taxonomy of perceptual continua proposed by Stevens (1957). S.D.

A76-32636 **Visual masking effects on duration, size, and form discrimination.** N. E. Cantor and E. C. Thomas (Stanford University, Stanford, Calif.). *Perception and Psychophysics*, vol. 19, no. 4, Apr. 1976, p. 321-327. 12 refs. NSF Grant No. GB-43275.

A visual noise mask was presented at variable delays after stimulus offset in order to interrupt processing and control the extent of processing time in duration, size, and form discrimination

tasks. Two sets of stimuli, a circle set and a nonsense form set, were used in both temporal and nontemporal discrimination tasks. Major conclusions are that perceived duration is greater for filled than for unfilled intervals in both stimulus set conditions and increases with stimulus area in the circle set condition, that both perceived duration and discrimination accuracy in the form set condition vary directly with stimulus duration and mask delay interval, and that manipulation of the mask delay interval does not influence perceived duration in the circle condition although discrimination accuracy is affected. Accuracy in size and form discrimination is enhanced with increases in processing time achieved through manipulation of either stimulus duration or mask delay interval. A model is proposed for prediction of processing time as a function of stimulus duration, mask delay interval, and the interval between onset of the mask and termination of processing. S.D.

A76-32637 Configurational effects in visual information processing. W. P. Banks (Pomona College, Claremont, Calif.) and W. Prinzmetal (Claremont Graduate School, Claremont, Calif.). *Perception and Psychophysics*, vol. 19, no. 4, Apr. 1976, p. 361-367. 13 refs. Research supported by the Pomona College; NSF Grant No. BMS-75-20328.

The experiments described show that the perceptual organization of a multielement display affects both the speed and accuracy with which a target letter in it is detected. The first two experiments show that a target is detected more poorly if it is arranged in good form (a perceptual Gestalt) with noise elements than if it is not. This effect is not confounded with target-noise proximity or display size, and it holds for stimuli terminated by the subject's response as well as for stimuli of very brief duration. Increasing the number of noise elements can actually improve performance if the added noise elements increase the degree to which the noise elements form perceptual groups separately from the target. A third experiment tries out a new method for scaling the perceptual structure of an array, and it shows that the main features of the first two experiments can be predicted from the scaled perceptual structure of the arrays they used. (Author)

A76-32666 The impact of nuclear medicine on the diagnosis and management of cardiovascular disease. E. H. Botvinick and D. M. Shames (California, University, San Francisco, Calif.). *IEEE Transactions on Nuclear Science*, vol. NS-23, June 1976, p. 1237-1242. 31 refs.

The capabilities of nuclear cardiology in the noninvasive diagnostic and therapeutic evaluation of cardiovascular disease in human subjects are reviewed. Particular attention is given to applications of noninvasive imaging techniques in four areas: myocardial perfusion imaging, blood pool imaging, infarct imaging, and left-to-right shunt study. Myocardial perfusion imaging reliably indicates the presence and location of regions with insufficient blood supply to meet stress demands. The diagnosis of heart muscle dysfunction and its complete noninvasive characterization can be achieved only by gated blood pool imaging. In infarct imaging, technetium pyrophosphate is deposited in regions of fresh infarction 12 hr to 1 wk following the insult, where the image shows excellent localizing value and may be valuable in infarct sizing. Left-to-right shunt can be reliably and inexpensively documented by radionuclide shunt study. The practical utility of imaging methods in various clinical settings is demonstrated. S.D.

A76-32667 Radiopharmaceuticals for studying heart disease. J. F. Lamb and H. S. Winchell (Medi-Physics, Inc., Emeryville, Calif.). *IEEE Transactions on Nuclear Science*, vol. NS-23, June 1976, p. 1243-1247. 21 refs.

Various procedures currently used in nuclear medicine for diagnosis of cardiovascular disorders by means of radiopharmaceuticals are examined, with particular reference to the nature, behavior, and potential of these radioindicators. The discussion is limited to the use of radionuclides in evaluating myocardial blood flow, myocardial contractility, extent of tissue damage from infarct and ischemia, and cardiovascular thrombi. Radiopharmaceuticals are subdivided into agents which remain in the blood and those which are removed from circulation. The problem of radioindicators with ideal characteristics for use in studying coronary heart disease is discussed. S.D.

A76-32668 Myocardial perfusion imaging for the detection of coronary heart disease. H. W. Strauss, D. J. Cook, I. Bailey, J. Rouleau, and B. Pitt (Johns Hopkins Medical Institutions, Baltimore, Md.). *IEEE Transactions on Nuclear Science*, vol. NS-23, June 1976, p. 1248-1250. 9 refs.

One of the primary goals of cardiological diagnostics is the very early detection of coronary artery disease before any major disabling event has occurred to damage the heart irreversibly. The paper outlines the concept and capabilities of regional myocardial perfusion imaging as a reliable noninvasive technique for determining the presence and location of regions with insufficient blood supply. The method employs a soluble radioactive cation, thallium-201, as the radiopharmaceutical. The regional distribution of thallium in the heart is actually reflecting the regional distribution of blood flow. The combination of this tracer with an imaging device permits external mapping of regional myocardial perfusion. The thallium-201 myocardial perfusion scan recorded following injection at stress is much brighter and better defined than that recorded with injection at rest. Future trends in noninvasive evaluation of regional myocardial perfusion are pointed out. S.D.

A76-32669 The measurement of ventricular function and the detection of wall motion abnormalities with high temporal resolution ECG-gated scintigraphic angiocardiography. M. V. Green, S. L. Bacharach, M. A. Douglas, B. R. Line, H. G. Ostrow, D. R. Redwood, J. J. Bailey, and G. S. Johnston (National Institutes of Health, Bethesda, Md.). *IEEE Transactions on Nuclear Science*, vol. NS-23, June 1976, p. 1257-1263. 13 refs.

A76-32813 # Psychological problems of interplanetary flight (Psikhologicheskie problemy mezhplanetnogo poleta). A. A. Leonov and V. I. Lebedev. Moscow, Izdatel'stvo Nauka, 1975. 248 p. 233 refs. In Russian.

The present work discusses problems related to the psychological compatibility of the crew members of an interplanetary spacecraft under conditions of group isolation and prolonged action of weightlessness on the psychological processes in man. Particular attention is devoted to the effect of sensory and informational 'hunger' on the development of unusual mental states. Other topics include emotional stress in space flight and rhythm of work and rest in space activities. The sociopsychological aspects of interplanetary flight are also examined. S.D.

A76-32873 * Selective attention and the auditory vertex potential. I - Effects of stimulus delivery rate. II - Effects of signal intensity and masking noise. V. L. Schwent, S. A. Hillyard, and R. Galambos (California, University, La Jolla, Calif.). *Electroencephalography and Clinical Neurophysiology*, vol. 40, June 1976, p. 604-622. 58 refs. Grants No. NIH-MH-25544-01; No. NGR-05-009-198.

The effects of varying the rate of delivery of dichotic tone pip stimuli on selective attention measured by evoked-potential amplitudes and signal detectability scores were studied. The subjects attended to one channel (ear) of tones, ignored the other, and pressed a button whenever occasional targets - tones of a slightly higher pitch - were detected in the attended ear. Under separate conditions, randomized interstimulus intervals were short, medium, and long. Another study compared the effects of attention on the N1 component of the auditory evoked potential for tone pips presented alone and when white noise was added to make the tones barely above detectability threshold in a three-channel listening task. Major conclusions are that (1) N1 is enlarged to stimuli in an attended channel only in the short interstimulus interval condition (averaging 350 msec), (2) N1 and P3 are related to different modes of selective attention, and (3) attention selectivity in multichannel listening task is greater when tones are faint and/or difficult to detect. S.D.

A76-32874 **The dimensionality of the human visual evoked scalp potential.** R. N. Kavanagh, T. M. Darcey, and D. H. Fender (California Institute of Technology, Pasadena, Calif.). *Electroencephalography and Clinical Neurophysiology*, vol. 40, June 1976, p. 633-644. 15 refs. Research supported by the Alfred P. Sloan Foundation; Grants No. NIH-NS-03627; No. NIH-GM-01335.

Principal component analysis and principal factor analyses are used to show that N simultaneous visual evoked-potential recordings from different electrode placements measure fewer than N independent variables and that processes chosen to model the underlying system must conform to this reduced dimensionality. The data are collected from experiments on an adult male subject with 41 channels recorded and on a female subject with 38 channels recorded. Analysis of data is carried out using two approaches: channels considered as variables and sample times regarded as variables. Principal component analysis indicates that six independent processes can account for approximately 97% of the variability in the data. Factor analysis and plots of the factor coefficients reveal that the time during which these principal factors are active agree well with the times at which the equipotential maps show some organized activity. The possibility of using a dipole to model the response is discussed, showing that its use is more plausible in the light of the results obtained. S.D.

A76-32875 **The stability of the sigma sleep spindle.** L. D. Silverstein and C. M. Levy (Florida, University, Gainesville, Fla.). *Electroencephalography and Clinical Neurophysiology*, vol. 40, June 1976, p. 666-670. 17 refs. Grant No. NIH-MH-16960.

The distribution of sigma sleep spindle activity in six normal human males who slept undisturbed for approximately 8 h/night for 7 consecutive nights was studied using an automatic spindle detector system which performed at 92.5% accuracy when judged against established visual criteria. The failure to detect significant differences among nights and the large intra-class correlation point to a noticeable inter-night stability of the sigma spindle. The sigma spindle activity in the terminal hour is depressed, reflecting the high proportion of REM sleep. The sigma spindle density yields consistent patterns within individual subjects. An anticipated, the density functions are greatest for stage 2 regarrless of night or hours within a night, negligible in stages 1 and REM, and intermediate for stages 3 and 4. There is enough evidence to support the hypothesis that sigma activity is unique to the sleeping EEG. S.D.

A76-32958 **Relative role of environmental and genetic factors in respiratory adaptation to high altitude.** S. Lahiri, R. G. DeLaney (Pennsylvania, University, Philadelphia, Pa.), J. S. Brody, J. Simpser (Boston University, Boston, Mass.), T. Velasquez (Lima, Universidad Nacional, Lima, Peru), E. K. Motoyama (Yale University, New Haven, Conn.), and C. Polgar (Children's Hospital, Detroit, Mich.). *Nature*, vol. 261, May 13, 1976, p. 133-135. 14 refs. NIH-supported research.

A76-33323 **The purple membrane of salt-loving bacteria.** W. Stoeckenius (California, University, San Francisco, Calif.). *Scientific American*, vol. 234, June 1976, p. 38-46.

An alternate photosynthetic system operative in halobacteria possessing the chromoprotein rhodopsin (but lacking chlorophyll) is described and research on the phenomenon is reviewed. The bacteriorhodopsin can be used to synthesize adenosine triphosphate (ATP) from adenosine diphosphate and inorganic phosphates in vitro or to drive various metabolic processes. The bacteriorhodopsin is incorporated in the halobacteria cell membrane, and converts light energy for proton transport across the membrane against an electric potential and a concentration gradient, via a proton pump (or ion pump) mechanism. The bacteriorhodopsin molecules are oppositely oriented on opposite sides of the cell membrane. A photoreaction cycle alternating between the purple rhodopsin complex absorbing at 570 nm and a bleached complex absorbing at 412 nm is described, as well as light-induced pH changes in cell suspensions, deprotonation and reprotonation processes, and possible chemisomotic energy transduction. R.D.V.

A76-33368 **Cross-modality determination of the subjective growth function for whole-body vertical, sinusoidal, vibration.** T. I. Hempstock and D. J. Saunders (Salford, University, Salford, England). *Journal of Sound and Vibration*, vol. 46, May 22, 1976, p. 279-284. 9 refs.

A cross-modality matching technique with both noise and vibration stimuli has been used to establish the subjective growth of whole body vertical sinusoidal vibration intensity. The results show that in the frequency range 5-80 Hz the growth functions are of the Stevens' power law form, expressed in terms of the subjective magnitude of the stimulus and the objective magnitude. The value of the growth parameter is found to be greatly influenced by the choice of the stimulus (noise or vibration) which serves as the dependent variable. The results of the study suggest that the concept of a vibration growth function should be regarded with a certain amount of caution. (Author)

A76-33369 **Mathematical modeling of air-to-ground target acquisition.** C. P. Greening (Rockwell International Corp., Anaheim, Calif.). *Human Factors*, vol. 18, Apr. 1976, p. 111-147. 46 refs. Contracts No. N00123-73-C-0250; No. N00123-74-C-0236.

Following a definition of relevant technical terms and the history of air-to-surface target acquisition modeling, six principal models of air-to-ground target acquisition modeling and prediction are described and compared in terms of structure, nature of model output, sensitivity to significant variables, and evidence of validity. The models discussed are the MARSAM II (Multiple Airborne Reconnaissance Sensor Assessment Model), GRC/A (General Research Corporation, Model A), SRI (a combination of two systems), VISTRAC (Visual Target Reconnaissance and Acquisition), DETECT II and III, and the visual model AUTONETICS. Particular attention is devoted to the geometric characteristics of the observer/observed world situation, characteristics of the visual scene to provide the clues needed for target acquisition, and characteristics of the observer. The models are incomplete in the sense that certain aspects of visual search are unaccounted in each. The implications of the features of existing models for current applications and future investigations are discussed. S.D.

A76-33370 **Signal complexity, response complexity, and signal specification in vigilance.** J. M. Childs (Wayland College, Plainview, Tex.). *Human Factors*, vol. 18, Apr. 1976, p. 149-159. 36 refs.

Sixty-four subjects served in a 50-min auditory monitoring task. Task complexity was examined with regard to both signal and response demands in an effort to determine variance contributing to each of these variables. Signals were presented at a mean rate of one per min, and no intersignal interval was greater than 2 min. Results showed that signal demands were of greater importance in affecting performance than were post-detection response contingencies. Statistically significant differences were obtained between groups monitoring only one signal and those monitoring any of seven signals, with the former condition exhibiting better performance over time. Groups in which signals were left unspecified exhibited lower detection percentages and higher false alarm rates than conditions in which signals were specified. No statistical differences between simple and complex response conditions were observed. Application of the present findings to applied environments is discussed. (Author)

A76-33371 **An airplane performance control system - A flight experiment.** C. A. Bergman (Singer Co., Binghamton, N.Y.). *Human Factors*, vol. 18, Apr. 1976, p. 173-181. 10 refs. Contract No. F44620-70-C-0105.

Pilot performance and preference measures were obtained for 12 pilots in actual flight operations using a twin-engine general aviation aircraft with both conventional controls and a Performance Control System (PCS). The PCS provides zero-order control of aircraft bank angle and vertical speed over the ranges of plus or minus 60 deg and plus or minus 457.2 m/min, respectively. An information-processing side-task was also used. With the PCS, flight error scores were reliably lower than with conventional aircraft controls. Pilot preferences, using a six-point scale, ranging from slight to moderate to strong preference for each of the two control systems, showed a moderate preference for the PCS as the median response. (Author)

A76-33372 **Continuous versus intermittent display of information.** S. P. Hepler (Wayne State University, Detroit, Mich.). *Human Factors*, vol. 18, Apr. 1976, p. 183-188. 5 refs.

Experiments were conducted on six undergraduate students (two males and four females) whose task was to study visually presented stimuli (4 x 4 matrices of consonants) and after the presentation report as much of the stimulus as possible. The two independent variables were the length of an individual presentation referred to as exposure duration and the number of individual presentations of the stimulus before the subject was allowed to respond. Both exposure duration and number of presentations are found to significantly affect the number of items reported, the number of presentations being the more important variable. An equation is proposed which relates the number of items reported to the total time the information is displayed and to the number of presentations. Three stages in the processing of visually presented information are identified: acquisition stage, consolidation stage, and retention stage. S.D.

A76-33376 **Study of the microbiological environment within long- and medium-range Canadian Forces aircraft.** A. J. Clayton (Defence Research Board, Directorate of Preventive Medicine, Ottawa, Canada), D. C. O'Connell, R. A. Gaunt, and R. E. Clarke (Defence Research Board, Directorate of Preventive Medicine, Ottawa; Defence Research Establishment Suffield, Ralston, Alberta, Canada). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 471-482. 11 refs.

Because of a possible requirement to carry patients with highly virulent communicable diseases, a study was undertaken to observe smoke patterns within Canadian Forces transport aircraft. This was followed by the quantitative evaluation of the spread of nonpathogenic organisms disseminated within a Boeing 707 and a C130 E (Hercules). Thirdly, an attempt to recover respiratory tract viruses during transatlantic flights was made. Smoke patterns showed that an infected patient should be placed at the rear of the aircraft. The spread of the nonpathogenic organisms in a 707 indicated that contamination was largely confined to the rear, except when the aircraft was in an unpressurized mode. In the C130E, contamination was shown to occur throughout the whole aircraft. No respiratory tract viruses were recovered during the transatlantic flights. It is essential that a 707 should be utilized for aeromedical evacuations. If a C130E is being considered, then a portable self-contained isolation care unit is mandatory. (Author)

A76-33377 **Bradycardia induced by negative acceleration.** J. A. Kennealy, J. S. Kirkland, and R. E. Sneider (USAF, Aerospace Medical Research Laboratory and Medical Center, Wright-Patterson AFB, Ohio). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 483, 484. 5 refs. USAF-sponsored research.

Four volunteers were subjected to negative acceleration in a human centrifuge for the purpose of testing a standard lap belt. Three subjects developed a sinus bradycardia. The fourth developed a sinus arrest with a junctional rhythm at -2 G. With return to +1 G, the sinus mechanism recovered with a prolonged P-R interval. Within 2 h, the P-R interval returned to normal. Negative acceleration maneuvers, well within the capabilities of high-performance aircraft, can effect marked changes in the cardiac rhythm. This phenomenon appears to be vagally induced and is remarkably well tolerated. (Author)

A76-33378 **Biomedical aspects of oxygen regulator performance. I - Static characteristics.** P. J. Zalesky and R. D. Holden (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 485-494. 6 refs.

Static performance characteristics of current-inventory USAF oxygen regulators were evaluated with the use of a specialized regulator test stand. Outlet suction pressures, flows, positive pressures, and delivered oxygen dilutions were monitored and recorded as functions of operational altitudes. General findings indicated that: excessive oxygen addition occurs in all models, especially at low cabin altitudes; positive pressure schedules generally conform to specifications; negative suction pressures for most regulators are less than -2.54 cm H2O. The validity of static evaluation is discussed and data interpretation is considered with respect to biomedical compatibility emphasizing maintenance of crewmember physiological sufficiency. (Author)

A76-33379 **Biomedical aspects of oxygen regulator performance. II - Dynamic characteristics.** P. J. Zalesky, R. D. Holden, and B. F. Hiott (USAF, School of Aerospace Medicine, Brooks AFB, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 495-502. 7 refs.

A quantitative assessment of currently available panel-and torso-mounted oxygen regulators and of several candidate torso-mounted models was carried out using the results of dynamic respiratory simulation tests and tests with human subjects. Existing oxygen delivery hardware was found to be very sensitive to the instantaneous flow requirement. The suction pressures were excessive during hyperventilatory conditions and potentially capable of inducing or worsening hyperventilation in aircrew members. Results indicate that oxygen regulators cannot be adequately evaluated static methods; dynamic criteria are indispensable and should include assessment of performance characteristics at the mask-user interface. C.K.D.

A76-33380 **Potassium losses in sweat under heat stress.** M. S. Malhotra, K. Sridharan, and Y. Venkataswamy (Defence Institute of Physiology and Allied Sciences, Delhi, India). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 503, 504. 15 refs.

Six healthy, heat-acclimatized subjects were exposed to different hot and humid environments in a climatic chamber and sodium, potassium, and chloride concentrations in their sweat, urine, and blood were determined. The concentration of potassium in sweat was found to be considerably higher than that in the plasma, whereas that of sodium and chloride was very much lower. The concentration of potassium in urine was also 8-12 times higher than that in the plasma as compared to 0.5 to 1.5 times higher for sodium and chloride. The total daily computed losses of potassium in sweat and urine, of a person working in severe heat in the tropics, can be about 116 mEq as against a dietary intake of 97 mEq/d, thereby resulting in negative potassium balance. The potassium depletion in sweat, even in acclimatized Indians, is thus heavy and is likely to play an important role in the causation of heat-illness. (Author)

A76-33381 **Ultrastructural effects of +Gz stress on swine cardiac muscle.** J. N. Lindsey, R. T. Dowell, L. A. Sordahl, H. H. Erickson, and H. L. Stone (Texas, University, Galveston, Tex.). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 505-511. 15 refs. Grant No. AF-AFOSR-74-2622.

Miniature swine were subjected to 9 G positive vertical acceleration for 60-120 s. Within 2 h following exposure, the anterior papillary muscle was removed and prepared for scanning and electron microscopy. Ultrastructural changes observed in the cardiac myocytes included cellular redistribution of mitochondria and nuclei. Tears in the contractile fibers, bizarre profiles or nuclei, and peculiar membrane-bounded bodies in the cytoplasm also were observed. Hemorrhagic areas were localized around the Purkinje fibers. The T system and plasma membrane appeared unperturbed. The conclusion was drawn that, following high levels of vertical acceleration, damage to myocardial ultrastructure ensues. (Author)

A76-33382 **Amelioration of the symptoms of acute mountain sickness by staging and acetazolamide.** W. O. Evans, S. M. Robinson, D. H. Horstman, R. E. Jackson, and R. B. Weiskopf (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 512-516. 23 refs.

Treatment of 4 d of residence at 1600 m plus the administration of 500 mg acetazolamide b.i.d. for the last 2 d at 1600 m and the first 2 d at 4300 m was compared with no treatment prior to ascent to 4300 m for prophylaxis of acute mountain sickness. The treatment successfully prevented almost all symptoms of acute mountain sickness. It had no effect on the diminished capacity for maximal or prolonged heavy physical work. The treatment produced a relative acidosis and a comparatively greater arterial oxygen tension at 4300 m. (Author)

A76-33383 **Mechanism of lung damage in explosive decompression.** E. D. L. Topliff (Defence and Civil Institute of Environmental Medicine, Downsview, Ontario, Canada). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 517-522. 10 refs.

It has been shown that closure of the trachea does not reduce mortality in mice subjected to maximally-rapid decompression, suggesting that under this condition the lungs and thorax may be treated as a closed system. Boyle's Law is invoked in the derivation of a formula for the transthoractic pressure generated during decompression. The mortality resulting from maximally rapid decompression is directly related to the transthoractic pressure. In slow decompression the transthoractic pressure gradient is degraded by lung expansion and by pressure equalization via the trachea. It is suggested that the maximally rapid decompression following a shock front may be responsible for pulmonary blast injuries. C.K.D.

A76-33384 **Algorithm for analyses of saccadic eye movements using a digital computer.** R. W. Baloh, W. E. Kumley, and V. Honrubia (California, University, Los Angeles, Calif.). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 523-527. 23 refs. Research supported by the Deafness Research Foundation; Grant No. PHS-NS-09823.

An algorithm for digital computer analyses of electro-oculografically recorded saccadic eye movements is presented. From a brief, 4-min recording session detailed statistical information about saccade velocity, accuracy, and delay time can be obtained. Since these data are not significantly altered by practice or motivational factors, it provides a sensitive functional test of the extra-ocular muscles and their brain control system. (Author)

A76-33385 **Method for determining pilot stress through analysis of voice communication.** I. Kuroda, O. Fujiwara, N. Okamura, and N. Utsuki (Japan Air Self-Defense Force, Aeromedical Laboratory, Tokyo, Japan). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 528-533. 9 refs.

A method has been developed for assessing the level of emotional stress of pilots in emergency situations from radio communications. The vibration space shift rate (VSSR) is calculated by comparing the widest vibration space (the space between the vertical deflections of vowel sounds in a sound spectrogram) of the voice during the normal phase of the flight in question with the widest vibration space occurring during the emergency situation. The VSSR is divided into three phases (normal, urgent, emergency), each containing three grades of 0.5 S.D. The proposed technique allows the evaluation of vocal cord tension, which is strongly affected by stress. A high VSSR rate throughout the emergency situation is frequently indicative of a fatal outcome associated with loss of ejection altitude, successive inappropriate reactions, or the inability to interpret advice, and may be a useful means of determining whether stress is a contributing factor in the outcome of an in-flight emergency. C.K.D.

A76-33386 **Prolactin, thyrotropin, and growth hormone release during stress associated with parachute jumping.** G. L. Noel, R. C. Dimond, J. M. Earll, and A. G. Frantz (U.S. Army, Walter Reed Army Institute of Research, Washington, D.C.; Columbia University; Presbyterian Hospital, New York, N.Y.). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 543-547. 25 refs.

Prolactin, growth hormone, and thyrotropin (TSH) release during the stress of parachute jumping has been evaluated in 14 male subjects. Subjects were studied at several times before and immediately after their first military parachute jump. All three hormones had risen significantly 1 to 14 min after the jump, compared to mean levels measured immediately beforehand. Earlier studies of physical exercise by ourselves and others would suggest that emotional stress played a role in producing changes of this magnitude. We conclude that prolactin, TSH, and growth hormone are released in physiologically significant amounts in association with the stress of parachute jumping. (Author)

A76-33387 **Heat and simulated high altitude - Effects on biochemical indices of stress and performance.** R. P. Francesconi, B. J. Fine, and J. L. Kobrick (U.S. Army, Research Institute of Environmental Medicine, Natick, Mass.). *Aviation, Space, and Environmental Medicine*, vol. 47, May 1976, p. 548-552. 32 refs.

Five healthy, military test volunteers were alternately exposed on separate days to sea level, control conditions (22-23 C, 40-50% relative humidity), a hot, wet environment (35 C, 90% relative humidity) or simulated high altitude (4300 m, 22-23 C, 20-30% relative humidity) while carrying out assigned performance tasks. Acute exposure of 7 h to environmental heat consistently elicited significant increments in plasma levels of cortisol, dopamine-beta-hydroxylase, and uric acid while cholesterol and cyclic AMP levels were unaffected. Alternatively, exposure to altitude for the same duration failed to effect significant alterations in any of the aforementioned biochemical factors. Although both environmental stresses caused similar performance decrements, the responses of biochemical indices of stress were consistently related to the environment itself. (Author)

A76-33448 * **Computer measurement and representation of the heart in two and three dimensions.** D. Rasmussen (NASA, Ames Research Center, Moffett Field, Calif.). In: Conference on Cardiovascular Imaging and Image Processing: Theory and Practice-1975, Stanford University, Stanford, Calif., July 10-12, 1975, Proceedings. Conference sponsored by Stanford University and NASA. Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 72), 1976, p. 177-182. 7 refs.

Methods for the measurement and display by minicomputer of cardiac images obtained from fluoroscopy to permit an accurate assessment of functional changes are discussed. Heart contours and discrete points can be digitized automatically or manually, with the recorded image in a video, cine, or print format. As each frame is digitized it is assigned a code name identifying the data source, experiment, run, view, and frame, and the images are filed for future reference in any sequence. Two views taken at the same point in the heart cycle are used to compute the spatial position of the ventricle apex and the midpoint of the aortic valve. The remainder of the points on the chamber border are corrected for the linear distortion of the X-rays by projection to a plane containing the chord between the apex and the aortic valve center and oriented so that lines perpendicular to the chord are parallel to the image intensifier face. The image of the chamber surface is obtained by generating circular cross sections with diameters perpendicular to the major chord. The transformed two- and three-dimensional imagery can be displayed in either static or animated form using a graphics terminal. C.K.D.

A76-33473 * **The effects of centrifugation on the morphology of the lateral vestibular nucleus in the rat - A light and electron microscopic study.** J. E. Johnson, Jr., W. R. Mehler, and J. Oyama (NASA, Ames Research Center, Neurosciences Branch, Moffett Field, Calif.). *Brain Research*, vol. 106, 1976, p. 205-221. 31 refs. NASA Task 970-21-11-11; NASA Task 970-21-61-14.

A76-33530 # The numerical thermal simulation of the human body when undergoing exercise or nonionizing electromagnetic irradiation. A. F. Emery, R. E. Short, A. W. Guy, K. K. Kraning (Washington, University, Seattle, Wash.), and J. C. Lin (Wayne State University, Detroit, Mich.). *(American Society of Mechanical Engineers, Paper 76-HT-KK,* 1976.) *ASME, Transactions, Series C - Journal of Heat Transfer,* vol. 98, May 1976, p. 284-291. 56 refs. U.S. Department of Health, Education and Welfare Grant No. 16-P-56818-013; Contract No. F41609-73-C-0002.

The human body was modeled by a finite difference numerical procedure to determine the effect of simulating the sweating rate by different analytical models. Six different models were used in which the hypothalamus, muscle, average skin, and local skin temperatures were used as the controlling parameters for the rate of local sweating. These different models were tested by comparing their predictions of local temperatures for an exercising man with measured values. The computer program was then used to compute the thermal response of a man subjected to microwave irradiation of the entire body and the head only. Transient head and body temperatures and sweating rates were computed and compared with the temperature changes due to an equivalent exercise level. Significant differences in the results found by using the different sweat models point out the need for further work in determining accurate analytical descriptions of this major mode of body heat loss. (Author)

A76-33546 Analytical methods for quantitative evaluation of the radiocardiagram. J. R. Wolberg (Technion - Israel Institute of Technology, Haifa, Israel), G. S. Freedman (Yale University, New Haven, Conn.), and A. Dwyer (St. Raphael Hospital, New Haven, Conn.). *(Israel Conference on Mechanical Engineering, 9th, Technion - Israel Institute of Technology, Haifa, Israel, July 1, 2, 1975.) Israel Journal of Technology,* vol. 13, no. 5, 1975, p. 309-315. 11 refs.

Radiocardiagrams are obtained by monitoring a radioisotope after injection as it passes through the heart and lungs. The purpose of this paper is to discuss several methods used to evaluate cardiac performance from radiocardiagram data. Mathematical models are developed for extracting two parameters of interest to cardiologists: (1) cardiac chamber flow to volume ratio (F/V), and (2) left ventricle ejection fraction (EF). The model used to characterize F/V is continuous and provides good agreement with data obtained by other physiological methods for the right heart. A discrete model is used to characterize the left heart and obtain EF. An important aspect of the EF model is that background interference is taken into consideration. The analyses include calculations of the statistical uncertainties associated with the computed values of both parameters. (Author)

A76-33566 # Sonic-boom-startle effects during simulated and actual automobile-driving tests. I. I. Glass, K. W. Lips, O. V. Nowakiwsky, and L. D. Reid (Toronto, University, Toronto, Canada). *Canadian Aeronautics and Space Journal,* vol. 22, Mar.-Apr. 1976, p. 70-88. 8 refs. Research supported by the Ministry of Transport and National Research Council of Canada; Grant No. AF-AFOSR-72-2274C.

Effects of SST-generated sonic booms on automobile driver performance were investigated on the basis of a simulation technique and actual driving tasks. The simulation results showed that some drivers were disturbed by sonic booms and took an average of 15 sec to recover from startle effects. The tests of actual driving performance involved tracking maneuvers and stopping tasks with and without booms of 150-Pa overpressure, 1-msec rise time, and 100-msec duration. Based on these results, it is concluded that overflights of commercial SSTs without sonic booms should not adversely affect a healthy driver's stopping distance or his ability to perform a demanding driving task. An examination of possible accident data during severe thunderstorms indicates that sonic booms are unlikely to make drivers accident prone. F.G.M.

A76-33570 Development of assembly robots (Entwicklung von Montagerobotern). L. Schmieder (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Dynamik der Flugsysteme, Oberpfaffenhofen, West Germany). *DFVLR-Nachrichten,* May 1976, p. 736, 737. In German.

The reported investigations concerning the development of robots make use of the results of studies related to the design of teleoperators for space applications. Considerations concerning supervisory control can be applied to industrial robots, in particular, those employed in assembly operations. Attempts to 'teach' a manipulator the writing of letters are discussed and a description is given of investigations related to the design of mechanical manipulating devices, giving attention to the optimum arrangement of six joints at a manipulator arm. G.R.

A76-33974 Evidence for the presence of eye movement potentials during paradoxical sleep in cats. K. Sakai and R. Cespuglio (Lyon I, Université, Lyons, France). *Electroencephalography and Clinical Neurophysiology,* vol. 41, July 1976, p. 37-48. 41 refs. Research supported by the Institut National de la Santé et de la Recherche Médicale; Centre Nationale de la Recherche Scientifique Contract No. LA-162; Direction des Recherches et Moyens d'Essais Contract No. 73/198.

A76-33975 Sleep in the young adult as seen from automatic analysis of records (Le sommeil du jeune adulte vu par analyse automatique des enregistrements). J.-M. Gaillard and R. Tissot (Clinique Psychiatrique de Bel-Air, Geneva, Switzerland). *Electroencephalography and Clinical Neurophysiology,* vol. 41, July 1976, p. 73-82. 21 refs. In French.

A previously described (Gaillard et al., 1971; 1973) automatic scoring technique was used to analyze the sleep records of a group of normal male and female subjects 20 to 29 years of age. Results were compared with data obtained by Williams et al., (1974) by visual analysis of the sleep records of a similar group of subjects. A high degree of correlation was found between results obtained by visual analysis and those obtained by automatic analysis of polygraph records. Stage 3 was slightly overestimated, and stage 4 underestimated, by automatic scoring in comparison with visual scoring. Automatic scoring detected a larger number of transitions between sleep stages and slightly underestimated REM sleep. C.K.D.

A76-34139 Survey of the state of the art of human biodynamic response. A. I. King (Wayne State University, Detroit, Mich.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 83-120. 149 refs. Contract No. N00014-75-C-1015.

Regional biodynamic response to impact acceleration is discussed with particular emphasis on the response of the head, spine, chest, and lower extremities. Head-injury mechanisms are described along with techniques for evaluating head impact tolerance and mathematical models of head impact. Data on the biodynamic response of the spine are reviewed, mechanisms of spinal and neck injury are identified, and mathematical models of the spine are assessed. Thoracic-injury mechanisms are noted together with models of the thorax, and data on injuries to the lower extremities are summarized. The formulation of more realistic models is recommended, some ground rules for impartial evaluation of a model are presented, and it is argued that head injury due to impact acceleration remains the most difficult problem in the study of human biodynamic response. F.G.M.

A76-34141 Injury criteria and human tolerance for the neck. C. L. Ewing (U.S. Navy, Naval Aerospace Medical Research Laboratory, New Orleans, La.). In: Aircraft crashworthiness; Pro-

ceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 141-151. 27 refs.

Crash injuries to the neck are discussed in terms of two types of injuries: those due to energy transmitted directly to the neck and those due to energy transmitted indirectly from either the torso or head. Causes of direct and indirect impact injuries to the neck are identified along with the types of injuries incurred and ways to prevent or attenuate dynamic response. Studies of neck tolerance limits that have been conducted on jet sleds with human subjects, other primates, and cadavers are reviewed. The present status of research and development in tolerance limits of the human neck is evaluated. It is suggested that the use of vehicular acceleration as a determinant of tolerance limits appears to have only limited application and that input to the neck should be measured directly. The construction is recommended of an analytical mathematical analog of the human response to peak impact acceleration from all vector directions for reasonable rates of onset and durations at peak acceleration. F.G.M.

A76-34142 **Standardization and interpretation of spinal injury criteria and human impact acceleration tolerance.** L. E. Kazarian (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 153-173. 6 refs.

The present paper identifies the level, type, severity, and mechanics of spinal injury that are revealed by the study of clinical and operational accident data. The biomechanics of vertebral trauma is discussed along with subtle fracture patterns, including compression fractures of the vertebral bodies, transverse-process fractures, and cleavage fractures of the vertebral centrum. The process of degenerative 'adaptive' musculoskeletal changes is described using data on various species of subhuman primates and apes subjected to +Gz impact forces. Human acceleration tolerance is defined in terms of standardized spinal-injury modes, and spinal injury is assessed in terms of acceptable, unacceptable, and radiologically concealed injuries. F.G.M.

A76-34143 **Head injury tolerance.** V. R. Hodgson and L. M. Thomas (Wayne State University, Detroit, Mich.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 175-193. 32 refs.

Head-injury tolerance levels are given for soft-tissue trauma, skull fracture, and brain injury. These include tolerance thresholds for clinically significant fractures when the contact area is 1 sq in.; thresholds of linear fracture for the front, side, and rear of the skull; and impact intensities producing marginal laceration through the scalp. Concussion tolerance to linear acceleration is analyzed, and studies which support the biomechanically established tolerance limits are discussed. F.G.M.

A76-34144 **Human head and neck dynamic response - analytical models and experimental data.** S. H. Advani, J. Huston, R. R. Powell, and W. Cook (West Virginia University, Morgantown, W.Va.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 197-212. 41 refs. Research sponsored by the U.S. Department of Transportation, Grant No. NIH-1-NS-42302.

Existing head-injury criteria are examined critically by means of regional mathematical modeling of the human head and neck system. Head-injury severity indices are discussed, and two head-injury continuum models are presented (translational acceleration and rotational acceleration). Head-neck impact-response models are also described, and selected correlations with experimental data on human-cadaver impact response are evaluated. The continuum models are shown to provide realistic estimates of the skull-brain-system response and to demonstrate that brain shear distortion is a critical parameter for injury. The head-neck models are found to simulate the experimental data accurately and to demonstrate that significant head angular accelerations are generated during impact. F.G.M.

A76-34145 **Simulating and modeling the human head's response to impact.** T. A. Shugar (U.S. Navy, Naval Construction Battalion Center, Port Hueneme, Calif.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 213-234. 26 refs. U.S. Department of Transportation Contract No. 4S-289-5501-A.

A state-of-the-art review of linear head-injury models based on the finite-element method is presented. The models are examined primarily in terms of geometrical representation, boundary-condition handling, material-property characterization, cost, and potential for nonlinear extension. Statistical data on the distribution and frequency of coup and contrecoup injuries are investigated along with data on the incidence of head injury in survivable accidents. It is shown that rotationally symmetric models cannot account for the asymmetric distribution of brain injuries reflected in the data because such models cannot distinguish frontal, side, and rear impacts from one another. A fully three-dimensional head-injury model computer code is described, and its development is traced from preliminary two-dimensional models to the present completed model. This code computes time histories of displacement, stress, and strain for arbitrary direct-impact loads and simulates the semisolid nature of brain material through a simple formulation that is best described as a shearless solid. F.G.M.

A76-34146 **Thoracic dynamics during blunt impact.** I. Kaleps (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 235-252. 18 refs. USAF-sponsored research.

The physical mechanisms leading to intrathoracic overpressures of sufficient amplitude to alter the force-deflection characteristics of the chest due to impact loading are demonstrated by applying a many-degree-of-freedom lumped-parameter model to the chest-impact problem. The model is formulated on the basis of available physiological data about thoracic structure and respiratory mechanisms combined with an analysis of body response dynamics during a frontal chest-impact event. It incorporates the elastic properties of the chest as well as the internal reactions of the viscera and air within the thorax and also accounts for total torso displacement and the dynamics of chest surface-tissues compression during impact. The results suggest that overpressure is a prime factor in the development of an injury index and show that overpressures of about 1 atm appear to lie in the injury borderline region. F.G.M.

A76-34147 **Intrusion of the sternum into the thoracic cavity during frontal chest impact and injury potential.** S. B. Roberts (California, University, Los Angeles, Calif.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 253-271. 15 refs.

The paper demonstrates how a linear finite-element representation of the human thorax can be used to assess the penetration of the sternum into the thoracic cavity and the internal stress state within the bony skeleton. The model discussed is THORAX IV A, a finite-element representation of a seated small-frame human which consists of three-dimensional beam elements representing the individual ribs, vertebrae, invertebral disks, and costal cartilage plus flat-plate elements describing the thorax. A criterion for potential injury to the pericardial region of the thorax is proposed on the basis of the notion that if sufficient anterior-posterior deformation of the chest occurs, the sternum will compress the pericardial region against the vertebral column and cause injury to the heart. A deformation value of 20% is proposed as a measure of incipient injury to the heart. The salient features of the analytical predictions obtained

from the present model are shown to compare favorably with experimental data in spite of numerous simplifying assumptions.
F.G.M.

A76-34148 **Spinal injury in the crash environment.** P. R. Payne (Payne, Inc., Annapolis, Md.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 273-298. 23 refs.

The paper discusses dynamic modeling of the spine in a crash situation when that structure is supported fore and aft by a shoulder harness and seat back and when the acceleration is primarily along the spine's axis. Criteria for choosing dynamic models are considered, the Dynamic Response Index (DRI) model is described, and biodynamic modeling of the spine as a supporting strut is examined. The gross dynamics of a seated human subjected to Gz acceleration is analyzed. A relationship between DRI and the probability of vertebral fracture is derived, and DRI values are plotted for various idealized acceleration pulse shapes. It is concluded that the DRI model is a useful tool in escape-system optimization and should be equally valuable in predicting the number of spinal injuries to be expected in a crash situation where only Gz acceleration is present.
F.G.M.

A76-34149 **Calspan three-dimensional crash victim simulation program.** J. T. Fleck (Calspan Corp., Buffalo, N.Y.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 299-310. 10 refs. Research sponsored by the U.S. Department of Transportation.

A computer program is described which can be used to study the highly variable three-dimensional contact-force environment and dynamics of a motor-vehicle crash victim, either occupant or pedestrian, such as experienced in oblique vehicle collisions or sideswipe pedestrian accidents. It is noted that one version of this program is available with three additional features that were developed to study the problem of pilot ejection. The evolution of the program through the three phases of its development is outlined, and the system equations are illustrated. These equations are derived from Euler's rigid-body equations in a manner that allows variation of the number of segments and joints in the formulation. The input to the program is described in detail. It is shown that this program can be applied to simulate an airplane occupant in crash environments, including in situations where the seat is a separate segment or set of segments. In these applications, both aerodynamic forces and generalized restraint-belt routines are included.
F.G.M.

A76-34150 **The UCIN 3-D aircraft-occupant.** R. L. Huston, C. E. Passerello, M. W. Harlow, and J. M. Winget (Cincinnati, University, Cincinnati, Ohio). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 311-324. 33 refs. NSF Grant No. GK-41272; Contract No. N0014-72-A-0027-0002.

The latest version of a three-dimensional aircraft-occupant model is presented with particular emphasis on its options, capabilities, and basic formulation. The code is a three-dimensional multisegment computer model designed primarily to study the dynamics of vehicle/occupant systems during crashes or periods of high acceleration; the model itself consists of 12 rigid bodies representing the human body and limbs together with a vehicle frame or cockpit. The fundamental dynamic equations are outlined, and some validation data are given. Examples are discussed which show the advantages of using combined shoulder- and lap-belt restraints as opposed to lap belts alone, particularly in the prevention of 'whiplash'.
F.G.M.

A76-34151 **PROMETHEUS - A crash victim simulator.** R. N. Karnes, J. L. Tocher, and D. W. Twigg (Boeing Computers Services, Inc., Seattle, Wash.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 327-346. 9 refs. U.S. Department of Transportation Contract No. HS-356-3-719; Contract No. N00014-72-C-0223.

The evolution of the PROMETHEUS crash-victim simulator is described along with the model's application to various problems. This simulator is an efficient user-oriented interactive crash-analysis program which simulates a crash victim with either a two-dimensional seven-link side-facing mathematical model restrained by a seat belt and shoulder harness (PROMETHEUS 1) or an eleven-link forward-facing unrestrained model (PROMETHEUS 2). A nonlinear finite-element model of the impacting structure is incorporated in both versions and interacts realistically with the occupant. The original program is discussed together with program restructuring into four modular sections, software improvements, and user convenience. Differences between the two versions are noted, several problems of mathematical simulation are illustrated, and it is concluded that the programs are particularly useful tools for parametric studies of the effects of severe impact situations on the human body.
F.G.M.

A76-34152 **Simulation of an aircraft seat and occupant in a crash environment.** D. H. Laananen (Pennsylvania State University, University Park, Pa.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 347-363. 11 refs. U.S. Department of Transportation Contract No. FA72WA-3101.

A digital computer program is described which has been developed for use in analysis and design of light-aircraft seats and restraint systems. The aircraft occupant is modeled by eleven rigid mass segments with rotational springs and dampers at the joints; the response of the occupant is described by Lagrange's equations of motion, which are written as functions of 28 independent generalized coordinates that define the position of the system. The seat model, divided into two major components, makes use of conventional finite-element techniques. The program input and initialization are outlined along with the solution procedure, program output, and computer resource requirements. Preliminary comparisons with experimental data show the predictions to be adequate at least for relative evaluation of system crashworthiness.
F.G.M.

A76-34153 **Advanced restraint systems for Army aircraft.** R. W. Carr (Ultrasystems, Inc., Phoenix, Ariz.) and G. T. Singley, III (U.S. Army, Air Mobility Research and Development Laboratory, Fort Eustis, Va.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 365-397. 12 refs. Army-supported research.

The paper describes the design and testing of U.S. Army helicopter crew and troop restraint systems. Preliminary webbing design criteria are presented, and results are discussed for analyses of static and dynamic webbing properties, material stiffness, restraint system slack, and energy-absorbing webbing. Test results are summarized for a prototype aircrew restraint system consisting of a single-point release buckle attached to a negative-g strap, right- and left-hand lap-belt assemblies with side straps, right- and left-hand shoulder straps, a shoulder-harness collar assembly, and two reflected straps attached to an inertia reel. The development of two troop restraint-system concepts is outlined, and static as well as dynamic test results are evaluated. It is noted that the troop and aircrew restraint systems passed both the static and dynamic tests and are believed to offer the best possible crash protection in light of the cost, weight, and operational factors.
F.G.M.

A76-34155 **An inflatable crewman restraint system.** M. Schulman (U.S. Naval Material Command, Naval Air Development Center, Warminster, Pa.). In: Aircraft crashworthiness; Proceedings of the Symposium, Cincinnati, Ohio, October 6-8, 1975. Charlottesville, University Press of Virginia, 1975, p. 447-463. 18 refs. Navy-supported research.

An inflatable restraint system for helicopter crews is described which automatically compensates for any slack in the system and pretensions the occupant in the seat during initial energy-absorption stroking. The system was designed according to the air-bag concept of enveloping the seated occupant with a gas-filled inflatable restraint, but the restraint is worn by a crewman instead of being remotely located from him. The major system components are identified, and results are reported for static preinflated testing, preinflated dynamic tests, and automatically inflated dynamic tests. Plans for more advanced prototype testing with human subjects are briefly noted. It is concluded that the present system will improve body and head restraint by automatically compensating for large variations in upper- and lower-adjustment slack. F.G.M.

A76-34228 # **Changes in the temperature of the hypothalamus during muscular contractions before and after cold adaptation (Izmenenie temperatury gipotalamusa pri sokrashcheniiakh myshts do i posle adaptatsii k kholodu).** V. E. Divert and M. A. Iakimenko (Akademiia Meditsinskikh Nauk SSSR, Novosibirsk, USSR). *Fiziologicheskii Zhurnal SSSR*, vol. 62, Apr. 1976, p. 523-527. 12 refs. In Russian.

A76-34229 # **Effect of temperature on the tonus of blood vessels (O vliianii temperatury na tonus krovenosnykh sosudov).** V. S. Kupriianov (Chuvashskii Gosudarstvennyi Universitet, Cheboksary, USSR). *Fiziologicheskii Zhurnal SSSR*, vol. 62, Apr. 1976, p. 573-577. 23 refs. In Russian.

Acute experiments were conducted on adult cats and frogs to evaluate the effect of temperature on the tonus of blood vessels under myographic monitoring of total elimination of muscular tonus in the limbs. The hypothesis that changes in vascular tonus under the influence of reduced temperature are due to the action of catecholamines is assessed. Enough evidence is obtained to suggest that increase in the tonus of peripheral vessels under the action of lowered temperature is attributed to release of catecholamines with adrenomimetic effect, their diffusion from the tissues surrounding the blood vessels, and subsequent action on the smooth muscle of the vascular wall. S.D.

A76-34424 **Color code size for searching displays of different density.** M.-C. Cahill and R. C. Carter, Jr. (Rensselaer Polytechnic Institute, Troy, N.Y.). *Human Factors*, vol. 18, June 1976, p. 273-280. 12 refs.

Twenty observers searched for three-digit numbers on displays ranging in density from 10 to 50 items coded in one through ten colors. Search times increased linearly with density and showed a curvilinear relation to number of colors used. An initial drop in search times as the first few colors were added to an uncoded display was followed by a rise in search times as still more colors were used. Minimal search times at different display densities were associated with different code sizes. Search times increased as more colors were added to the code, even when the number of items per color category was constant. The detrimental effect on search times of larger code sizes is interpreted as a camouflage of the color contour of the target's class by the multiple color boundaries in the heterogeneous background. (Author)

A76-34425 **Estimating the amount of eye movement data required for panel design and instrument placement.** J. J. Seeberger and W. W. Wierwille (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *Human Factors*, vol. 18, June 1976, p. 281-292. 10 refs.

A76-34450 * **Amino acids of the Nogoya and Mokoia carbonaceous chondrites.** J. R. Cronin and C. B. Moore (Arizona State University, Tempe, Ariz.). *Geochimica et Cosmochimica Acta*, vol. 40, July 1976, p. 853-857. 12 refs. NSF Grant No. DES-74-05178. Grant No. NGL-03-001-001.

Amino acids were found in acid hydrolyzed, hot water extracts of the Nogoya (C2) and Mokoia (C3V) chondrites. About 40 n moles/g of amino acids were found in the Nogoya extract while Mokoia contained less than 1 n mole/g. The amino acid composition of Nogoya differs from that of other C2 chondrites studied earlier. The results from Mokoia are similar to previous data obtained from the C3V chondrite Allende. (Author)

A76-34497 * **Light-induced glutamate transport in Halobacterium halobium envelope vesicles. I - Kinetics of the light-dependence and the sodium-gradient-dependent uptake.** J. K. Lanyi, V. Yearwood-Drayton (NASA, Ames Research Center, Biological Adaptation Branch, Moffett Field, Calif.), and R. E. MacDonald (NASA, Ames Research Center, Biological Adaptation Branch, Moffett Field, Calif.; Cornell University, Ithaca, N.Y.). *Biochemistry*, vol. 15, no. 8, 1976, p. 1595-1603. 59 refs.

A76-34500 * **Effects of high-LET particles /A-40/ on the brain of Drosophila melanogaster.** J. Miquel (NASA, Ames Research Center, Moffett Field, Calif.), M. M. Herman (Stanford University, Stanford, Calif.), E. V. Benton (San Francisco, University, San Francisco, Calif.), and G. Welch (California, University, Berkeley, Calif.). *International Journal of Radiation Biology*, vol. 29, no. 2, 1976, p. 101-124. 37 refs. Grant No. NIH-NS-08276.

To investigate the effects of galactic heavy particles on nervous tissue, Drosophila melanogaster flies were exposed to A-40 from the Super-HILAC accelerator at the Lawrence Berkeley Laboratory. The energy of the particles reaching the Drosophila neurons was 4.8 MeV/nucleon, and the fluence ranged from 60,000 to 80 million particles/sq cm. Thirty-five days after irradiation at the higher fluences, extensive tissue fragmentation and cysts were found. At fluences as low as one hit/two cell bodies (about 5 million) and one hit/90 cell bodies (about 90,000 particles/sq cm or 21 rad average dose) swelling of neuronal cytoplasm and focally fragmented membranes were noted; at fluences ranging from one hit/six to one hit/135 cell bodies, there was frequently a marked increase in glial lamellae around nerve-cell processes, which often had degenerative features. These findings support the view that single hits by heavy particles may injure nervous tissue. (Author)

A76-34532 * **Angiocardiography - Past and present.** H. Sandler (NASA, Ames Research Center, Biomedical Research Div., Moffett Field, Calif.). In: Conference on Cardiovascular Imaging and Image Processing: Theory and Practice - 1975, Stanford University, Stanford, Calif., July 10-12, 1975, Proceedings. Conference sponsored by Stanford University and NASA. Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 72), 1976, p. 83-93. 24 refs.

Angiocardiography is defined as an X-ray procedure which uses an intravascularly injected contrast material for visualization of the internal anatomy of the heart and great vessels. Past and present efforts in angiocardiography technology and methodology are reviewed, with special emphasis on qualitative and quantitative measurements of heart and vessel geometry. One of the more recent applications of angiographic image analysis has been for pattern recognition of margin motions over a cardiac cycle, termed contourography. Angiocardiography will continue to serve, as it has served in the past, as the principal standard of reference for calibration and/or comparison of newer methods for determining volume or dimensional change, depending on further technologic advances in X-ray equipment and means for displaying computer-processed information. S.D.

A76-34585 **Theory of spatial-frequency filtering by the human visual system. I - Performance limited by quantum noise. II - Performance limited by video noise.** A. D. Schnitzler (Institute for Defense Analyses, Arlington, Va.). *Optical Society of America, Journal*, vol. 66, June 1976, p. 608-625. 36 refs.

Harmonic analysis and statistical decision theory are combined in a quantitative description of spatial-frequency filtering in the human visual system in the vicinity of the sine-wave modulation threshold in the absence of perceptible light fluctuations. The spatial-frequency response (SFR) of the human visual system is derived from threshold modulation data. Independent decision centers and associated photoreceptive fields (PRF) are incorporated into the model. Detection of sinusoidal gratings near threshold with perceptible luminous fluctuations caused by voltage fluctuations at a CRT display control grid is analyzed theoretically. A technique is advanced for determining modulation sensitivity functions (MSF) of single detection channels from threshold modulation data. Relationships with spatial impulse response (SIR) functions and noise-required-modulation (NRM) functions, and modulation transfer functions (MTF) are discussed, for the retina-brain subsystem and for external optics. R.D.V.

A76-34691 # **A study of the primary processes of the photo-induced evolution of hydrogen by Chlorella under flash illumination (Issledovanie pervichnykh protsessov fotoindutsirovannogo vydeleniia vodoroda Khlorelloi pri impul'snom osveshchenii).** E. I. Efimtsev, V. A. Boichenko, N. E. Zatolokin, and F. F. Litvin (Moskovskii Gosudarstvennyi Universitet, Moscow; Akademiia Nauk SSSR, Institut Fotosineza, Pushchino-on-Oka, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 227, Mar. 21, 1976, p. 731-734. 13 refs. In Russian.

A76-34699 # **Activation of RNA biosynthesis in the liver and spleen of irradiated rats (Aktivatsiia biosinteza RNK v pecheni i selezenke obluchennykh krys).** V. I. Tokarskaia, S. R. Umanskii, O. I. Skotnikova, and A. M. Kuzin (Akademiia Nauk SSSR, Institut Biologicheskoi Fiziki, Pushchino-on-Oka, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 227, Apr. 1, 1976, p. 988-990. 10 refs. In Russian.

Initial stages in the radiation-induced breakdown of biosynthesis of ribonucleic acids in rat organs differing in radiosensitivity, specifically liver and spleen, are investigated. Sedimentation tests after ultracentrifugation in a sugar gradient revealed 'superproduction' of giant nuclear RNA in the first 30 min following irradiation. Total-body irradiation of rats at 800 r brought about irreversible alterations in liver and spleen tissue, so that earlier observations of intensified liver RNA synthesis accompanied by inhibition of spleen RNA synthesis must be some secondary effect associated with the corticosteroid concentration in the blood of the exposed animals. R.D.V.

A76-34700 # **Determination by impedance of the volume of gas bubbles in the blood resulting from a decrease in atmospheric pressure (Opredelenie po impedansu ob'ema gazovykh puzyr'kov v krovi, voznikaiushchikh pri snizhenii atmosfernogo davleniia).** A. A. Shurubura, V. V. Petrash, V. A. Voinov, and E. N. Danilov (Leningradskii Nauchno-Issledovatel'skii Institut Skoroi Pomoshchi; Vsesoiuznyi Institut Pul'monologii, Leningrad, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 227, Apr. 1, 1976, p. 1021-1024. 14 refs. In Russian.

The total volume of gas bubbles in whole and heparinized canine and human blood and in normal saline during decompression at the rate of 100 mm Hg/10 sec was determined from changes in impedance and sample volume. The formation of gas bubbles in whole canine blood occurred from the beginning of depressurization. The introduction of heparin impeded the appearance of gas bubbles. Whole human blood yielded the same results as heparinized canine blood. Measurement of thoracic impedance during decompression in intact mice with and without the introduction of heparin gave results similar to those obtained with whole and heparinized canine blood, respectively. C.K.D.

A76-34716 # **Some statistical patterns in the control of vascular thermoregulatory responses (O nekotorykh statisticheskikh zakonomernostiakh upravleniia sosudistymi termoreguliatornymi reaktsiiami).** Ia. A. Bedrov and B. I. Gekhman (Akademiia Nauk SSSR, Vychislitel'nyi Tsentr and Laboratoriia Termoreguliatsii i Bioenergetiki, Leningrad, USSR). *Fiziologicheskii Zhurnal SSSR*, vol. 62, May 1976, p. 754-761. 20 refs. In Russian.

The thermoregulatory vascular response of the floor of the ears in intact rabbits exposed to changes in the ambient temperature from 15 to 40 deg C was investigated. A statistical analysis of experimental results shows that the thermoregulatory response is switched on (off) when the weighted sum of the temperature of the hypothalamus, skin temperature of the back, and the rate of change of skin temperature attains (decreases to) a certain extreme value. Quantitative expressions describing this process are obtained. C.K.D.

A76-34786 * **The prospects for life on Mars - A pre-Viking assessment.** C. Sagan (Cornell University, Ithaca, N.Y.) and J. Lederberg (Stanford University, Stanford, Calif.). *Icarus*, vol. 28, June 1976, p. 291-300. 45 refs. Grants No. NGR-33-010-101; No. NGR-05-020-004; Contract No. NAS1-9683.

The paper considers implications of the Mariner 9 findings for the investigation of Martian biology in the next decade, beginning with the Viking mission. Previous claims for observations of Martian biological activity are reviewed and refuted or reinterpreted. The question is raised of whether there are combinations of environmental temperature and water activity on Mars that are suitable for a conceivable Martian biology. Four possible classes of Martian organisms associated with temperature/water ecological niches in the external environment are proposed: organisms requiring high temperatures and high water activity, those inhabiting niches with low temperatures and high water activity, those inhabiting niches of high temperature and low water activity, and those which can survive under conditions of low temperature and low water activity. It is noted that organisms of the last two classes may extract water from minerals or from ice and may be of large dimensions. The possible surface distribution of Martian organisms is discussed along with future search strategies for life on Mars. F.G.M.

A76-34817 **Some studies on the capabilities and limitations of humans to judge frequency of vibration applied to whole body.** B. K. N. Rao (Birmingham, University, Birmingham, England). *Journal of Sound and Vibration*, vol. 46, June 8, 1976, p. 456-461.

A76-35175 # **Physiological and psychological preparation of pilots for function in the presence of high altitude cabin depressurization (Psikhofiziologicheskaia podgotovka letchikov k deistviiam pri razgermetizatsii kabin na bol'shikh vysotakh).** I. N. Chernikov, V. G. Kuznetsov, V. F. Zhernavkov, E. A. Kozlovskii, R. N. Makarov, and I. V. Maksimov. *Voenno-Meditsinskii Zhurnal*, Mar. 1976, p. 53-57. In Russian.

It has been shown that pilots can be prepared for effective function in the case of cabin depressurization using a ground-based training unit. During simulation of cabin depressurization, trainees use the high altitude gear for breathing under excess pressure designed for use at the altitude 'ceiling' of the aircraft in question. The flight tasks executed by the trainees under simulated depressurization are matched in duration and complexity with those typical of high-altitude flight. Effective evaluation of the performance of individual trainees can be carried out in one session; a second session is necessary only for those pilots that did not perform satisfactorily during the initial training period. C.K.D.

A76-35201 * # **Visual/motion simulation of CTOL flare and touchdown comparing data obtained from two model board display systems.** R. V. Parrish, J. D. Rollins (NASA, Langley Research Center, Hampton, Va.), and D. J. Martin, Jr. (Sperry Rand Corp., Hampton, Va.). *American Institute of Aeronautics and Astronautics, Visual Motion Simulation Conference, Dayton, Ohio, Apr. 26-28, 1976, Paper 76-1709*. 13 p. 8 refs.

Acquisition of a modern terrain model board display system for

'out-the-window' scene presentation has allowed for the repetition of an evaluation study of combined visual/motion cues for CTOL flare and touchdown control that was originally carried out on a 1965 vintage landing display system. The motion drive system used in both studies was a nonlinear coordinated adaptive washout based on the method of continuous steepest descent optimization. Comparisons of the results of the studies present flare and touchdown data, as well as dynamic response data, from the two visual landing systems. The new visual system also allowed for the repetition, under visual conditions, of a subjective comparison of a linear and a nonlinear motion washout method done previously under instrument conditions.

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N76-24245 European Space Agency, Paris (France).
AIRCRAFT NOISE IN RESIDENTIAL AREAS: MEASUREMENT AND ANALYSIS
Hans Otto Finke, R. Martin et al *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 35-47 refs Transl. into ENGLISH from Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 35-42

An interdisciplinary investigation was carried out on the effects of aircraft noise on man in the vicinity of airports. The sociological, psychological and physiological effects and the conditions under which they occur, were investigated. The manner in which the ambient environment on the psychical or somatic properties of individuals affect their reactions to aircraft noise were determined. The interrelationship of acoustic noise load parameters and the reactions of those affected was studied. The program was carried out in the proximity of a major airport and covered the following activities: sociological interviews, psychological and psycho-physiological experiments, medical anamnesis, and flight noise measurements. ESA

N76-24246 European Space Agency, Paris (France).
NOTES ON NOISE INDEX NUMBERS (TAKING INTO ACCOUNT THE RESULTS OF THE MUNICH AIRCRAFT NOISE INVESTIGATION CARRIED OUT BY THE GERMAN RESEARCH ASSOCIATION)
Klaus Matschat, E. A. Mueller, G. Zimmermann et al *In its* Engine Noise (ESA-TT-244) Feb. 1976 p 48-52 refs Transl. into ENGLISH from 'Triebwerkslaerm', DGLR, Cologne Report DLR-Mitt-74-21, 1974 p 43-47

The problem of characterizing the average annoyance effect of a long period noise event (lasting hours or days), as described by the noise level time history (L(t)), by a single number, is discussed. Such a number is defined as the noise index. As a rule the formulas from which the noise index is calculated, based on L(t), are derived from laboratory and field investigations in which a prescribed noise situation and the reaction shown by a group of test subjects are recorded simultaneously. Proposals of extended noise indices were made, accounting for the effect of noise level fluctuation. An equation for an index of this kind was derived. ESA

N76-24876# Rochester Univ., N.Y. Dept. of Microbiology.
THE PHYSIOLOGICAL BASES FOR MICROBIAL BAROTOLERANCE Annual Technical Report, 31 Dec. 1974 - 31 Dec. 1975
Robert E. Marquis 31 Dec. 1975 33 p
(Contract N00014-75-C-0634; NR Proj. 136-924)
(AD-A018892; TR-4) Avail: NTIS CSCL 06/19

The inhibition of streptococcal growth by hydrostatic pressure was found to be the result of an increased demand for adenosine triphosphate under pressure coupled with a somewhat diminished supply. The increased demand seemed to be due to pressure stimulation of membrane adenosine triphosphatase. it was found also that pressure markedly upsets electrolyte balances in organisms such as Streptococcus faecalis but not in organisms such as Escherichia coli or Bacillus licheniformis. Data is presented in this report to suggest that one atmosphere is not the optimal growth pressure for many bacteria, but that growth at 100 atmospheres and a temperature slightly above the optimum is faster and more extensive than is growth at any temperature at one atmosphere. Data is presented also to show that bacterial growth under nonoptimal conditions is highly sensitive to pressure, and that at the low temperatures in natural aquatic environments, pressures as low as 50 atmospheres can have major inhibitory effects on growth of mesophilic or psychrotrophic bacteria. Finally, it was found that high-pressure oxygen stimulates synthesis and excretion of materials that absorb light of 260 nm wavelength and that the toxicity of oxygen may be related to derangements in nucleic acid metabolism. Author (GRA)

N76-24877# Seton Hall Univ., South Orange, N.J. Dept. of Biology.
THE EFFECT OF HYPERBARIC OXYGEN AND HELIUM ON VIRUS REPLICATION AND HOST PATHOLOGY Final Report, 1 Apr. 1968 - 31 Jul. 1974
Ernest V. Orsi 31 Dec. 1975 8 p
(Contract N00014-68-A-0340-0001)
(AD-A018894; TR-2) Avail: NTIS CSCL 06/13

There is strong experimental evidence that virus infection after exposure to hyperbaric oxygen stress 'favors the virus over the host cell'. Viral mRNA degredation is lessened by diminution of lysosomal RNA-ase leakage. In turn the interferon synthesizing capability of the host is markedly reduced by direct action of hyperbaric oxygen or compounds such as adrenochrome which mimic its action under normal pressure. GRA

N76-24878*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MEDICAL MICROBIOLOGICAL ANALYSIS OF APOLLO-SOYUZ TEST PROJECT CREWMEMBERS
Gerald R. Taylor and S. N. Zaloguev Apr. 1976 26 p refs
(NASA-TM-X-58180; JSC-11021) Avail: NTIS HC $4.00 CSCL 06E

The procedures and results of the Microbial Exchange Experiment (AR-002) of the Apollo-Soyuz Test Project are described. Included in the discussion of procedural aspects are methods and materials, in-flight microbial specimen collection, and preliminary analysis of microbial specimens. Medically important microorganisms recovered from both Apollo and Soyuz crewmen are evaluated. Author

N76-24879*# Stanford Univ., Calif. Integrated Circuits Lab.
ULTRASONIC DOPPLER MEASUREMENT OF RENAL ARTERY BLOOD FLOW Progress Report, 1 Mar. 1974 - 31 Aug. 1975
William R. Freund and James D. Meindl Aug. 1975 91 p refs
(Grant NGR-05-020-615)
(NASA-CR-148131; SEL-76-004) Avail: NTIS HC $5.00 CSCL 06B

An extensive evaluation of the practical and theoretical limitations encountered in the use of totally implantable CW Doppler flowmeters is provided. Theoretical analyses, computer models, in-vitro and in-vivo calibration studies describe the sources and magnitudes of potential errors in the measurement of blood flow through the renal artery, as well as larger vessels in the circulatory system. The evaluation of new flowmeter/transducer systems and their use in physiological investigations is reported. Author

N76-24880*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECTS OF A 12-HOUR SHIFT IN THE WAKE-SLEEP CYCLE ON PSYSIOLOGICAL AND BIOCHEMICAL RESPONSES AND ON MULTIPLE TASK PERFORMANCE Final Report
E. A. Higgins (FAA, Oklahoma City, Oklahoma), W. D. Chiles

(FAA, Oklahoma City, Oklahoma), J. M. Mckenzie (FAA, Oklahoma City, Oklahoma), P. F. Iampietro (AFOSR, Arlington, Va.), C. M. Winget, G. E. Funkhouser (FAA, Oklahoma City, Oklahoma), M. J. Burr (FAA, Oklahoma City, Oklahoma), J. A. Vaughan (FAA, Oklahoma City, Oklahoma), and A. E. Jennings (FAA, Oklahoma City, Oklahoma) Washington FAA Oct. 1975 27 p refs
(NASA-TM-X-74115; AD-A021518/6; FAA-AM-75-10) Avail: NTIS HC $4.00 CSCL 06/19

Fifteen male volunteers were studied in three groups of five each. The first 4 days of the experiment they slept nights and worked days. On the fifth night, they slept only 3 hours before starting a 10-day period in which the wake-sleep cycle was altered by 12 hours. According to a subjective sleep survey, the total quantity and quality of sleep did not change significantly when the cycle was altered. According to the subjective fatigue index, the total fatigue for the awake periods was not significantly changed. The times within days for greatest fatigue were altered and 9 days were required for a complete reversal of the daily pattern. Of the physiological parameters measured, those making the most rapid response to stress rephased in the shortest period of time after the shift. From the shortest to longest mean rephasal times, these were: heart rate norepinephrine, epinephrine, potassium, sodium, internal body temperature, and 17-ketogenic steroids. Author

N76-24881# Veterans Administration, Washington, D.C. Research Center for Prosthetics.
BULLETIN OF PROSTHETICS RESEARCH, SPRING 1975
1975 408 p refs
(AD-A018516; BPR-10-23; LC-66-60273) Avail: NTIS CSCL 06/12

Contents: Editorial-control concepts in prosthetics; Physical response of SACH feet under laboratory testing; Electrode implantation in the human body; New head Control for Quadriplegic patients; The Lift lock--a device to increase the lifting ability of dual-control prostheses; A voluntarily controlled electrohydraulic above-knee prosthesis; Computer optimization of polycentric prosthetic knee mechanisms; Transferring load to flesh-part VIII. Stasis and stress; A five-year review of clinical experience with Johns Hopkins University externally powered upper-limb prostheses and orthoses; VA prosthetics center research report; Highlights of other VA research programs. GRA

N76-24882# Army Research Inst. of Environmental Medicine, Natick, Mass.
US ARMY MEDICAL RESEARCH AND DEVELOPMENT TECHNICAL REPORT Annual Progress Report, 1 Jul. 1974 - 30 Jun. 1975
1 Jul. 1975 182 p refs
(DA Proj. 3A7-62758-A-827; DA Proj. 3A1-61102-B-71R)
(AD-A018435) Avail: NTIS CSCL 06/5

Contents: Prevention of military environmental medical casualties by improved information transfer; Biomedical impact of military clothing and equipment design including the selection of crew compartment environments; Prevention and treatment of disabilities associated with military operations in the heat; The relationship between physical exercise and the health, efficiency and morale of the soldier; Development of performance measures for simulated and real military team tasks; Development and characterization of models of heat injuries and disabilities and other heat responses of the soldier; Preservation of myelinated peripheral nerve; and metabolic aspects of thermoregulation. GRA

N76-24883# School of Aerospace Medicine, Brooks AFB, Tex.
ANALYSIS OF HUMAN BODY COMPOSITION DATA AS RELATED TO HEIGHT AND AGE Final Report, Feb. 1964 - Aug. 1971
Clarence F. Theis Oct. 1975 43 p refs
(AF Proj. 7930)
(AD-A018350; SAM-TR-75-38) Avail: NTIS CSCL 06/16

In this study, human body composition was determined on 696 male volunteers. The study was a cross sectional study and covered a period of time from February 1964 to August 1971. Data including age, barefoot height, nude body weight, volume of displacement, fat, lean body mass, and residual lung volume were obtained on each subject. From these data, both simple and multiple linear regression equations based on height and age were computed for each of the following variables: Body weight, lean body mass, fat mass, fat/body weight ratio, fat/lean body mass ratio, density, and residual lung volume. Tolerance limits were also computed for the simple linear regression equations. Author (GRA)

N76-24884# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHAIR FOR STUDYING VESTIBULAR ANALYZER
V. Belkin 23 Apr. 1975 10 p Transl. into ENGLISH from Meditsinskaya Gazeta (USSR), no. 7, 22 Jan. 1975 p 3
(AD-A018251; FTD-ID(RS)I-1232-75) Avail: NTIS CSCL 05/10

The chair's operating principle is based on stimulating the vestibular analyzer of the individual being studied by creating different angular accelerations. Biopotentials are transmitted from the individual under observation to recording instruments by a collector installed on the chair's rotational axis. When necessary, the chair's back can be adjusted and fixed in any inclined position - from vertical to horizontal. A free-standing panel controls the chair's operation. The chair's functional possibilities are on a level with the best models in the world. The time of the action of acceleration is set automatically. GRA

N76-24885# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF BREATHING 100 PERCENT OXYGEN ON SHORT-TERM MEMORY OF MILITARY OFFICERS WHILE UNDER HEAT STRESS M.S. Thesis
Robert Louis Krubsack Sep. 1975 42 p refs
(AD-A018321) Avail: NTIS CSCL 06/19

Using a serial short term memory task, subjects were required to respond to symbols presented one-back, two-back, and three-back from a randomly presented list of four different symbols while breathing either 100 percent oxygen or atmospheric air with an oxygen mask in a heat stressful environment. The purpose of the experiment was to determine if breathing 100 percent oxygen had any effect on the short term memory of a subject under heat stress. Analysis of the data collected from 10 subjects under heat stress indicated breathing pure oxygen had no effect in the 15 minute period on short term memory. GRA

N76-24886# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF ALCOHOL INGESTION ON SHORT TERM MEMORY AND ATTENTION M.S. Thesis
Christopher Michael Grauert Sep. 1975 60 p refs
(AD-A018311) Avail: NTIS CSCL 06/15

Using a serial short term memory task, subjects were required to respond to stimuli presented one-back, two-back, and three-back from a random sequence of four different symbols before alcohol ingestion, after alcohol ingestion and again after alcohol with motivation. The purpose of the experiment was to determine whether alcohol had an adverse effect on Short Term Memory and, once intoxicated, whether the degradation of Short Term Memory could be overcome by attention. Analysis of the data collected from 10 subjects showed that alcohol adversely affected Short Term Memory in all three delay modes, while motivation had no effect in overcoming this Short Term Memory degradation due to alcohol ingestion. Author (GRA)

N76-24887# Army Research Inst. of Environmental Medicine, Natick, Mass.
A SQUIRREL MONKEY BEHAVIORAL MODEL FOR HUMAN ACUTE MOUNTAIN SICKNESS
L. E. Banderet Apr. 1975 23 p refs
(DA Proj. 3A1-61102-B-71R)
(AD-A019177; USARIEM-M-30-75) Avail: NTIS CSCL 06/19

The research determined if squirrel monkey (SM) behavioral changes at high altitude are a model for human acute mountain sickness (AMS). Two monkeys were studied at 0, 3,700, 4,000 and 4,300 m in chambers instrumented for continuous measurement of climbing and chamber location. Food and water consumption and body weight were measured daily. All measures

ere incrementally sensitive to altitude levels, and their time ourses resembled that for human AMS. In another study, ehavioral changes at high altitude were minimal when a treatment egime beneficial for man was investigated. Thus, SM behaviors t high altitude appear a promising model for the evaluation of rophylactic strategies and study of human AMS. GRA

N76-24888# Army Research Inst. of Environmental Medicine, Natick, Mass.
EFFECTS OF HYPOXIA ON PERIPHERAL VISUAL RESPONSE TO DIM STIMULI
John L. Kobrick. Apr. 1975. 28 p. refs
(DA Proj. 3A7-62758-A-827)
(AD-A019106; USARIEM-M-31-75) Avail: NTIS CSCL 06/19

Response times (RT's) of 9 Ss were obtained for detection of 48 flash stimuli distributed throughout the visual field during 3 1/4 hour exposures to each of 4 hypoxia conditions (0, 13,000, 15,000, 17,000 feet equivalent elevation). The luminance of all stimuli were set in common at the detection threshold value for the visual periphery. RT's were impaired in direct relation to hypoxic exposure severity, the peak impairments occurring within 90 minutes followed by gradual recovery. Since the present results showed less impairment than previous data for brighter stimuli using the same task, it is concluded that stimulus contrast is more critical to peripheral signal detection than absolute stimulus luminance, particularly under hypoxia exposure. GRA

N76-24889# Army Research Inst. of Environmental Medicine, Natick, Mass.
RADIOGRAPHIC CHANGES IN CARDIAC DIMENSIONS DURING EXHAUSTIVE EXERCISE IN MAN
John T. Maher, George A. Beller, John M. Foster, and L. Howard Hartley. Sep. 1975. 20 p. refs
(DA Proj. 3A1-61102-B-71R)
(AD-A019100; USARIEM-M-8-76) Avail: NTIS CSCL 06/16

To further characterize the cardiocirculatory response to endurance exercise, serial changes in transverse cardiac diameter (TCD) were evaluated noninvasively using a roentgenographic technique. Forty-inch ECG-synchronized anteroposterior X-rays of the chest were taken of 9 healthy young men at rest, during the course of supine bicycle exercise, and at exhaustion. Exposures were triggered in end-diastole during end-expiration. Under the conditions of this study, the normal physiologic response of decrease in heart size with increase in heart rate was observed. GRA

N76-24890# Undersea Medical Society, Bethesda, Md.
PROCEEDINGS OF THE UNDERSEA MEDICAL SOCIETY WORKSHOP (7TH) ON MEDICAL ASPECTS OF SMALL SUBMERSIBLE OPERATIONS
D. A. Hall and P. G. Linaweaver. 1975. 204 p. refs. Workshop held at Submarine Devel. Group 1, San Diego, Calif., 19-20 Nov. 1974
(Contract N00014-74-C-0319)
(AD-A018474; WS-7-1-75) Avail: NTIS CSCL 06/19

Contents: Background information; Submersible incidents; Behavioral considerations; Unique vehicles; and Non-U.S. submersible program summaries. GRA

N76-24891# Logical Technical Services Corp., New York.
INVESTIGATIONS INTO THE RELIABILITY OF ELECTROPHOTOGRAPHY Final Report
David Faust, Graham L. Gross, Harry J. Kyler, and John O. Pehek. 30 Sep. 1975. 85 p. refs
(Contract MDA903-75-C-0208; ARPA Order 2812)
(AD-A018806; FR-1) Avail: NTIS CSCL 06/16

Investigations into corona-discharge photography show that subjects placed in a high-voltage field exhibit corona that may be recorded photographically. The corona formation and structure depend on the applied field strength and gradient, the type of film used, and the waveform and the pulse repetition rate of the applied voltage. Specimen properties affecting corona formation include resistivity, geometry, and moisture content; other factors may also be important. The discharge mechanism is similar to that of classical point to plane studies. CD photography is successfully used to study temperature dependence of skin hydration in distilled water and saline solutions. Evidence indicates that variations in certain physiological parameters may be used to determine response to psychological stimuli via corona discharge photography. GRA

N76-24892# Armed Forces Radiobiology Research Inst., Bethesda, Md.
POLAROGRAPHIC MEASUREMENT OF LOCAL CEREBRAL BLOOD FLOW IN THE CONSCIOUS AND ANESTHETIZED PRIMATE
J. M. Fein, J. A. Willis, J. R. Hamilton, and L. J. Parkhurst. Aug. 1975. 33 p. refs
(DNA Proj. NWED-QAXMC912)
(AD-A018665; AFRRI-SR-75-24) Avail: NTIS CSCL 06/16

This study was undertaken to evaluate the brain hemodynamics of the primate Macaca mulatta in the conscious and anesthetized state. A polarographic circuit was utilized for repetitive measurements of local and average total cerebral blood flow in the conscious state, during analgesia-paralysis and in the anesthetized state. The electrochemical considerations and in vitro testing are described. Blood flow values were highest in sensory and motor cortex (92.5 + or - 3.5 and 86.2 + or - 2.6 ml/100 g per min), while there were no significant differences found between other regions of association cortex. Mean deep grey matter blood flow values ranged between 57.6 + or - 3.8 and 69.2 + or - 3.4 ml/100 g per min. The mean local blood flow for the centrum semiovale was found to be 19.5 + or - 1.2 ml/100 g per min, and that for pontine tegmentum was 58.1 + or - 3.5 ml/100 g per min. At any one electrode locus, at steady-state levels of arterial blood gases, the reproducibility of blood flow ranged between 11-18 percent. Seventy-five percent nitrous oxide-25 percent oxygen in combination with a paralytic agent produced a questionably significant drop in caudate nucleus blood flow. The depressant effects of anesthetic doses of sodium pentobarbital on cerebral blood flow, however, were significant at most electrode sites. These data indicate that the measured blood flow rates within small brain volumes are critically affected by barbiturate anesthesia and seriously question the value of published reports in which these agents were utilized. Author (GRA)

N76-24893# School of Aerospace Medicine, Brooks AFB, Tex.
AN AUTOMATED DMFB METHOD FOR THE DETERMINATION OF URINARY AMINO NITROGEN Final Report, Jun. 1974 - Jul. 1975
Jesus B. Garcia, Jr. and Frank Bernal. Dec. 1975. 10 p. refs
(AF Proj. 7930)
(AD-A018720; SAM-TR-75-43) Avail: NTIS CSCL 06/1

A method using 2,4-dinitrofluorobenzene (DNFB) is described for the automatic determination of urinary amino nitrogen. Based on existing manual methods, it introduces reagents that are easily adaptable to automated techniques. A mean urinary amino nitrogen value of 77.1 mg amino N/gm creatinine was obtained for a group of healthy male subjects, compared to a range of 52 to 80 mg reported by other investigators. Direct comparison of analytical results obtained by the automated method and a manual DNFB method on several urine samples yielded a mean difference of 1.34% between the methods. Author (GRA)

N76-24894*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
PSYCHOPHYSICAL RELATIONSHIPS CHARACTERIZING HUMAN RESPONSE TO WHOLE-BODY SINUSOIDAL VERTICAL VIBRATION
Jack D. Leatherwood and Thomas K. Dempsey. Washington, Jun. 1976. 35 p. refs
(NASA-TN-D-8188; L-10496) Avail: NTIS HC $4.00 CSCL 05E

An experimental investigation determined that the psychophysical relationships between subjective discomfort evaluations to vibratory stimuli and subjective evaluations of the intensity of vibratory stimuli can be expressed in a linear fashion. Furthermore,

significant differences were found to exist between discomfort and intensity subjective response for serveal but not all discrete frequencies investigated. The implication of these results is that ride quality criteria based upon subjective evaluation of vibration intensity should be applied cautiously in the development of criteria for human comfort. Author

N76-24895# Naval Training Equipment Center, Orlando, Fla.
ADAPTIVE TRAINING OF MANUAL CONTROL: PERFORMANCE MEASUREMENT INTERVALS AND TASK CHARACTERISTICS In-house Report, Sep. 1974 - Sep. 1975
G. L. Richard and D. A. Norman. Nov. 1975. 21 p. refs
(AD-A019233; NAVTRAEQUIPC-IH-252) Avail: NTIS CSCL 05/9

An experiment is reported concerning relations between the measurement of trainee performance and parameters of the simulated airframe of an adaptive, aircraft roll-control, training task. Five values for the performance measurement interval (PMI) were chosen so as to bracket the roll rate time constant of the simulator's lateral transfer function, and an acquisition-then-transfer experimental design was used to assess trainee skill development. When the PMI was shorter than the break frequency of the lateral transfer function, subjects experienced greater difficulty in developing criterion-level control than when longer PMI's were used. GRA

N76-24896# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CREW AND NEW SYSTEMS
N. Rudnyi and V. Ponomarenko. 12 May 1975. 20 p. Transl. into ENGLISH from Aviatsiya i Kosmonavtika (USSR), no. 9, 1974 p 34-36
(AD-A018253; FTD-ID(RS)I-1256-75) Avail: NTIS CSCL 05/5

The report discusses aviation accidents as related to the psychological and mental characteristics of man in a performance environment, and stresses taking these factors into account when planning and designing new aviation technology. GRA

N76-24897# Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN EXPERIMENTAL EVALUATION OF THE SPOT WOBBLE METHOD OF SUPPRESSING RASTER STRUCTURE VISIBILITY Technical Report, 1 Mar. 1973 - 1 Mar. 1974
William S. Beamon and Harry L. Snyder. Nov. 1975. 47 p. refs
(Contract F33615-71-C-1739)
(AD-A018566; AMRL-TR-75-63) Avail: NTIS CSCL 05/5

Television displays generate an image composed of a number of parallel raster lines. These lines, when visible, act as an interfering pattern and detract from operator performance in obtaining information from the video system. One way to reduce line visibility is to deflect the scanning spot vertically as it scans; this technique is commonly termed spot wobble. An experiment was conducted which evaluated changes in operator performance as indicated by the ranges at which targets were acquired and the number of correct responses to target presentation in a simulated air-to-ground search task. These performance parameters were evaluated at four spot wobble amplitudes and three viewing distances. The main findings were that spot wobble had no significant effect on the number of correct responses, but that large-amplitude spot wobble significantly increased the ranges at which targets were acquired. Additionally, several subjective indicators of preferred image quality were evaluated, and show that there is wide variance among subjects as to what image characteristics they prefer. GRA

N76-24898# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
EVALUATION OF THE EC II PROGRAMMABLE MAINTENANCE SIMULATOR IN T-2C ORGANIZATIONAL MAINTENANCE TRAINING Final Report
Joann Wright and Jane Campbell. 15 May 1975. 41 p. refs
(AD-A012336; NADC-75083-40) Avail: NTIS CSCL 05/9

An evaluation was conducted of the EC 2 training device, a computerized programmable simulator, used in three system courses of the T-2C Organizational Maintenance Training Program: the hydraulics and flight controls course, the environmental (utility) system course and the power plants and related systems course. The findings indicate that the simulator proved at least as equally effective as the conventional hardware units when used to teach general maintenance procedures. Author

N76-24899# Air Force Human Resources Lab., Brooks AFB, Tex.
USAF EVALUATION OF AN AUTOMATED ADAPTIVE FLIGHT TRAINING SYSTEM Interim Report, Jan. - Dec. 1974
James E. Brown, Wayne L. Waag, and Edward E. Eddowes. Oct. 1975. 62 p. refs
(AF Proj. 1123)
(AD-A018612; AFHRL-TR-75-55) Avail: NTIS CSCL 05/9

The objectives of the study were: (1) to evaluate the training effectiveness of the Automated Flight Training (AFTS) in the F-4 training program; (2) to identify desired hardware and software modifications for operational AFTS devices; and (3) to identify effective methods of operational training use. The study was performed at Luke AFB, Arizona at the request of the Tactical Air Command (TAC). A class of 24 students assigned to F-4 combat crew training was randomly divided in two equal sized groups. One group received GCA training using the AFTS. The other group received normal GCA training from F-4 instructors. Performance data, questionnaire data, and maintenance data were collected and analyzed. Implications of the data for future use and procurement of additional systems are discussed. GRA

N76-24900* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SELF-CONTAINED BREATHING APPARATUS Patent
John L. Sullivan (Scott Aviation Corp.), Eugene A. Giorgini (Scott Aviation Corp.), and Milo R. Simmonds, inventors (to NASA) (Scott Aviation Corp.) Issued 18 May 1976. 17 p. Filed 11 Nov. 1974. Supersedes N75-13534 (13 - 04, p. 0457). Sponsored by NASA
(NASA-Case-MSC-14733-1; NASA-Case-MSC-14735-1; US-Patent-3,957,044; US-Patent-Appl-SN-522971; US-Patent-Class-128-142.2; US-Patent-Class-128-203; US-Patent-Class-137-DIG.9; US-Patent-Class-137-110) Avail: US Patent Office CSCL 06K

A self-contained breathing apparatus with automatic redundant fluid pressure controls and a facemask mounted low pressure whistle alarm is described. The first stage of the system includes pair of pressure regulators connected in parallel with different outlet pressures, both of which reduce the pressure of the stored supply gas to pressures compatible with the second stage breathing demand regulator. A primary regulator in the first stage delivers a low output pressure to the demand regulator. In the event of a failure closed condition of the primary regulator, an automatic transfer valve switches on the backup regulator. A warning that the supply pressure has been depleted is also provided by a supply pressure actuated transfer valve which transfers the output of the first stage pressure regulators from the primary to the backup regulator. The alarm is activated by either the failure closed condition or if the supply pressure is reduced to a dangerously low level.
Official Gazette of the U.S. Patent Office

N76-24901*# Rockwell International Corp., Downey, Calif. Space Div.
STUDY TO DETERMINE EXTRAVEHICULAR MOBILITY UNIT (EMU) ADVANCED TECHNOLOGY REQUIREMENTS VOLUME 1: EXECUTIVE SUMMARY Final Report
7 May 1976. 20 p. refs. 2 Vol.
(Contract NAS2-8957)
(NASA-CR-137840; SD-76-SA-0026-Vol-1) Avail: NTIS HC $3.50 CSCL 06K

Requirements are derived for extravehicular mobility units that are responsive to the needs of typical shuttle payloads. Requirements which might require technology advances are stressed. Author

N76-24902*# Rockwell International Corp., Downey, Calif. Space Div.
STUDY TO DETERMINE EXTRAVEHICULAR MOBILITY UNIT (EMU) ADVANCED TECHNOLOGY REQUIREMENTS. VOLUME 2: TECHNICAL ANALYSIS Final Report
7 May 1976 114 p refs 2 Vol
(Contract NAS2-8957)
(NASA-CR-137841; SD-76-SA-0026-Vol-2) Avail: NTIS HC $5.50 CSCL 06K
For abstract, see N76-24901

N76-24903*# Old Dominion Univ. Research Foundation, Norfolk, Va.
DEVELOPMENT OF RIDE COMFORT CRITERIA FOR MASS TRANSIT SYSTEMS Final Report
Raymond H. Kirby, Peter J. Mikulka, and Glynn D. Coates May 1976 32 p refs
(Grant NsG-1042)
(NASA-CR-147962; PR-76-7) Avail: NTIS HC $4.00 CSCL 05H

Two studies were conducted on the effects of simultaneous sinusoidal vibration in the vertical and lateral axes on ratings of discomfort in human subjects in a simulated passenger aircraft. In the first experiment each of 24 subjects experienced each of ten levels of vertical frequency in combination with each of ten levels of lateral frequency vibration and rated the discomfort produced on a nine-point, unipolar scale. In the second experiment 72 subjects experienced one of four levels of vertical frequency at each of four levels of vertical amplitude combined with 16 (or 4 x 4) lateral frequency and amplitude conditions. The results of these two studies strongly suggest that there are effects on discomfort that occur when subjects are vibrated in several axes at once that cannot be assessed with research using vibration in only one axis. Author

N76-24904*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
PPP EFFECTIVENESS STUDY
James D. Arbet and R. L. Benbow 7 May 1976 42 p refs
(Contract NAS9-14780)
(NASA-CR-147720; Design-Note-17) Avail: NTIS HC $4.00 CSCL 05H

This design note presents a study of the Procedures and Performance Program (PPP) effectiveness. The intent of the study is to determine manpower time savings and the improvements in job performance gained through PPP automated techniques. The discussion presents a synopsis of PPP capabilities and identifies potential users and associated applications. PPP effectiveness, and PPP applications to other simulation/training facilities. Appendix A provides a detailed description of each PPP capability. Author

N76-24905# Army Aeromedical Research Lab., Fort Rucker, Ala.
THE USE OF OPAQUE LOUVRES AND SHIELDS TO REDUCE REFLECTIONS WITHIN THE COCKPIT, COMPUTER PROGRAMS FOR TWO APPROACHES TO THE PROBLEM Final Report
Wun C. Chiou, Frank F. Holly, Chun K. Park, and Alford A. Higdon, Jr. Nov. 1975 22 p refs
(AD-A018468; USAARL-76-6) Avail: NTIS CSCL 05/5

Opaque shields can be used to channel light and thereby reduce reflections within the cockpit. These shielding devices range from the standard glare shield on top of the instrument panel to the more experimental use of Light Control Film and Micromesh for this purpose. Previous work in this series has demonstrated two mathematical approaches to a specific reflection problem in the AH-1 aircraft, namely, the reflections coming from the portion of canopy directly above the gunner's head. It was felt that it would be useful to demonstrate the compatibility of these two approaches and to publish the computer programs (FORTRAN) for each approach for possible use by others. GRA

N76-24906# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DESIGN OF AN OPTICAL LINK FOR A SIDE-MOUNTED HELMET DISPLAY USING OFF-THE-SHELF LENSES M.S. Thesis
James T. Larkins Mar. 1975 111 p
(AD-A018332; GEO/PH/75-6) Avail: NTIS CSCL 05/8

The Helmet-Mounted Display (HMD) is a primary component of a Visually-Coupled System (VCS). Commercially available optical links for the HMDs are available but expensive. Ray-tracing techniques were employed to investigate the possibility of using 'off-the-shelf' lenses in an optical link. Four inexpensive, simple-magnifier systems were designed and evaluated with a new device, the HMD optical test instrument. The theory of geometric optics limits such an optical to the simple-magnifier systems. GRA

N76-24907# Systems Technology, Inc., Hawthorne, Calif.
EFFECTS OF WIDEBAND AUDITORY NOISE ON MANUAL CONTROL PERFORMANCE AND DYNAMIC RESPONSE Final Report, Jul. 1971 - Mar. 1975
R. Wade Allen and Henry R. Jex Oct. 1975 31 p refs
(Contract F33615-73-C-4003; AF Proj. 7231)
(AD-A018667; STI-TR-1027-2; AMRL-TR-75-65) Avail: NTIS CSCL 05/8

Noise is a common stress in the aerospace environment, and the purpose of this study was to investigate its effect on manual control performance and associated behavior. Nine subjects were subjected to white noise at four intensity levels of 55 db, 75 db, 95 db, and 115 db while performing a simulated pitch/roll tracking task with a high attentional demand. Performance actually improved under noise, presumably due to an arousal effect. The human operator's dynamic response properties were not affected by noise, however, and the performance effects arose from a reduction in remnant (subject tracking noise) and possibly cross coupling internal to the operator. A measure of subjective reaction to the noise environment showed high sensitivity to the various noise levels and some habituation over three experimental sessions. Also, tracking performance showed steady improvement over the three sessions, probably due to learning. Author (GRA)

N76-25758*# Texas A&M Univ., College Station. Biology Dept.
SUPPORT OF IN-FLIGHT EXPERIMENTS Final Report
Karl P. Kuchnow 31 May 1976 175 p refs
(Contract NAS9-13647)
(NASA-CR-147748) Avail: NTIS HC $6.75 CSCL 06F

An outline of the various techniques used and the results obtained of attempts to achieve satisfactory preservation of ova and sperm of Fundulus heteroclitus are discussed in terms of the greatest amount of time that fertility could be retained, and also the retention of maximum fertility. Also included are the results of tests on delayed embryogenesis, should the preservation of individual gametes not prove feasible, as well as preliminary treatment of data on the orientation of ASTP juveniles. Author

N76-25759*# Old Dominion Univ., Norfolk, Va.
A STUDY OF THE EFFECT OF LIGHT ON THE EMISSION OF TERPENES FROM CERTAIN WOODY PLANTS
Lee M. Coppedge [1975] 16 p refs
(Grant NGL-47-003-067)
(NASA-CR-148142) Avail: NTIS HC $3.50 CSCL 02F

Terpenes emitted from the intact uncrushed foliage of some common southeastern Virginia plants are identified along with terpene emission rates observed during illumination. J.M.S.

N76-25760# Minnesota Univ., Minneapolis. Chronobiology Labs.
CIRCADIAN RHYTHMS IN PLANTS, INSECTS AND MAMMALS EXPOSED TO ELF MAGNETIC AND/OR ELECTRIC FIELDS AND CURRENTS Final Report
Franz Halberg, Laurence Cutkomp, Ealter Nelson, and Robert Sothern 28 Aug. 1975 68 p refs
(Contract N00014-67-A-0113-0026)
(AD-A019958) Avail: NTIS CSCL 06/16

Proceeding on the basis of knowledge that circadian rhythms

are a predictable source of biological variability with characteristics that can change in response to potentially harmful agents, studies were performed on plants, insects and mammals in the presence and absence of ELF fields and currents. Specifically, circadian rhythms were examined in leaf movements of Albizzia julibrissin (silk tree), in susceptibility of Tribolium confusum (flour beetle) to an insecticide, in body temperature and drug resistance of Mus musculus (mouse). In the latter animal body weight, food consumption, the estrus cycle and survival were also investigated. Field conditions ranged from 45 to 75 Hz, 0.4 to 2 gauss and 1 to 180 v/m. Duration of field exposure varied from a few days to several months. Such exposure was consistent with the demonstration of statistically significant circadian rhythms.
GRA

N76-25761*# Methodist Hospital, Houston, Tex.
REPORT OF 14-DAY BEDREST SIMULATION OF SKYLAB
Philip C. Johnson, comp. and Cheryl Mitchell, comp. 7 Jun. 1976 331 p refs
(Contract NAS9-14578)
(NASA-CR-147758) Avail: NTIS HC $10.00 CSCL 06S

Part one of a two-phase bedrest project in which the physiological effects of weightlessness were simulated is presented. The project was designed to approximate the medical testing and dietary control of Skylab. The test period included a three week pre-flight period, a two week bedrest period and a two week post-flight period. The test subjects ate measured amounts of the Skylab diet and drank deionized water to recreate the metabolic balance studies of Skylab. The medical testing program, pre- and postbedrest, was similar to that of Skylab including: lower body negative pressure testing the orthostatic intolerance noted after both spaceflights and bedrest, bicycle ergometry testing the cardiovascular response to graded exercise, postural equilibrium, vestibular studies and electromyograms. Fluid and electrolyte shifts and balance were documented with intake and output records and radionuclide studies. The subjects were observed by a psychiatrist who watched for signs of mental stress in the test environment and changes in mental status.
A.S.K.

N76-25762*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ELECTROMYOGRAPHIC ANALYSIS OF SKELETAL MUSCLE CHANGES ARISING FROM 9 DAYS OF WEIGHTLESSNESS IN THE APOLLO-SOYUZ SPACE MISSION
E. V. LaFevers, Nicogossian, and W. N. Hursta Apr. 1976 36 p refs Prepared in part by Technology Inc., Houston, Tex.
(NASA-TM-X-58177; JSC-10876) Avail: NTIS HC $4.00 CSCL 06S

Both integration and frequency analyses of the electromyograms from voluntary contractions were performed in one crewman of the Apollo-Soyuz Test Project mission. Of particular interest were changes in excitability, electrical efficiency, and fatigability. As a result of 9 days of weightlessness, muscle excitability was shown to increase; muscle electrical efficiency was found to decrease in calf muscles and to increase in arm muscles; and fatigability was found to increase significantly, as shown by spectral power shifts into lower frequencies. It was concluded from this study that skeletal muscles are affected by the disuse of weightlessness early in the period of weightlessness, antigravity muscles seem most affected by weightlessness, and exercise may abrogate the weightlessness effect. It was further concluded that electromyography is a sensitive tool for measuring spaceflight muscle effects.
Author

N76-25763# Oak Ridge National Lab., Tenn.
RADIATION GENETIC EFFECTS OF ELECTRON VACUUM TUBES OF A RADAR STATION
O. A. Stykan [1975] 4 p refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), vol. 7, no. 36-38, Jul. 1967 4 p Sponsored by ERDA
(ORNL-TR-4053) Avail: NTIS HC $4.50

Results of studies are reported that indicate that in the working areas of a radar station there are sources of soft X radiation whose intensity exceeds the maximum permissible values of dose for the station, but observance of the safety rules will ensure protection of personnel from the action of radiation. Non compliance with safety rules in regulating and installation of equipment may result in soft X irradiation of personnel. For further insurance of prevention of undesirable effects of radiation on personnel working at a radar station for extended times, direct studies of the chromosomes of the somatic cells should be made by cultivation of leucocytes of the peripheral blood, which permit judging the mutagenic action of different factors on human chromosomes.
Author (ERA

N76-25764# United Nuclear Industries, Inc., Richland, Wash.
AUDITABLE PROGRAM OF COMPLIANCE WITH ALAP
Leo H. Munson and Linda A. Freytag 12 Nov. 1975 12 p refs Presented at the 9th Topical Symp. on Operational Health Physics, Denver, Colo., 9 Feb. 1976
(Contract AT(45-1)-1857)
(UNI-SA-15; Conf-760202-15) Avail: NTIS

Increasing public and government pressure is being felt by all sectors of the nuclear industry to demonstrate compliance to maintaining occupational radiation exposures as low as practicable (ALAP). Systematic approach to occupational radiation exposure reduction is described which will not only reduce radiation exposure usage but will provide an auditable record of compliance with ALAP. The essential features of the program include guidelines for identification and appreciation of tasks which involve significant amounts of radiation exposure, the contribution of the Health Physicist in reducing radiation exposure, and a matrix for evaluation of feasibility, practicality, and economics of each application.
Author (NSA

N76-25765# Los Alamos Scientific Lab., N.Mex.
AVERAGE NEUTRON ENERGY MEASUREMENT AT AN ACCELERATOR FACILITY, A PRACTICAL HEALTH PHYSICS PROBLEM
A. J. Miller 1975 6 p refs Presented at 9th Topical Symp. on Operational Health Phys., Denver, 9 Feb. 1976
(Contract W-7405-eng-36)
(LA-UR-75-2235; Conf-760202-12) Avail: NTIS HC $4.50

Surveys designed to estimate the average energy of neutrons escaping from shielded enclosures were made. Information obtained from these data proved to be of value in establishing response factors for the personnel monitoring dosimeters (NTA film). The value of measuring average neutron energies was demonstrated when the monthly film badge report indicated significant neutron exposures to personnel. Neutron radiation survey data, as well as recorded data from area monitoring stations, indicated much lower personnel neutron doses. Subsequent average neutron energy measurements, at the location of interest, revealed a well defined region where average neutron energies were considerably greater than previously measured in other occupied areas of the accelerator facility. A discussion is given of the rationale for the decision to alter for these experiments the NTA film response factors from that normally applied to the LAMPF film badges.
Author (ERA

N76-25766# Army Research Inst. of Environmental Medicine, Natick, Mass.
INCREASED 2,3-DIPHOSPHOGLYCERATE DURING NORMOCAPNIC HYPOBARIC HYPOXIA
Allen Cymerman, John T. Maher, Julio C. Cruz, John T. Reeves, and Joseph C. Denniston 5 Dec. 1975 30 p refs
(DA Proj. 3A7-62758-A-827)
(AD-A019513; USARIEM-M-34-75) Avail: NTIS CSCL 06/19

Maintenance of normal plasma pH at high altitude (HA) by acetazolamide has been shown to prevent the HA-induced change in 2,3-diphosphoglycerate (DPG) and P50. To establish whether this phenomenon occurs if hypocapnia is prevented, five subjects (Group I) and four subjects (Group II) were exposed to 440 torr with 3.7% CO2 supplemented and 455 torr with no CO2 supplemented for five days, respectively. Similar alveolar oxygen tensions were maintained in both groups. Group I P50s were significantly increased on days 2-5, while no changes were observed in Group II until day five. Both groups had significant elevations in DPG above sea-level values after two days. Mean corpuscular hemoglobin concentrations (MCHC) remained within normal limits during the first two days, then decreased significantly

below sea-level values in Group I (days 3-5) and Group II (days 4-5). Thus prevention of respiratory alkalosis by CO2 supplementation is accompanied by increases in P50 and DPG; these changes occur independently of changes in MCHC. GRA

N76-25767# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE PDP-15 ELECTROCARDIOGRAM ANALYSIS SYSTEM, A FURTHER ATTEMPT AT CONTINUOUS REAL-TIME OPERATIONS M.S. Thesis
Robert L. Woerlee Dec. 1975 129 p
(AD-A019809; GE/BE-75-44) Avail: NTIS CSCL 06/12

The thesis describes a continued development of a real-time EKG analysis system using the PDP-15 computer. The system was developed as a joint-effort between the Air Force Institute of Technology and the Cox Heart Institute. The program employs previously proven pattern recognition techniques on patient EKG data from the CCU at Kettering Memorial Hospital. The thesis delineates the program modifications and additions employed to achieve real-time operation. GRA

N76-25768# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EFFECTS OF ALTERATION OF SPATIAL FREQUENCY CONTENT OF COMPLEX SCENES ON HUMAN VISUAL SCAN PATTERNS M.S. Thesis
Carey M. Capell Dec. 1975 74 p refs
(AD-A019854; GE/BE/75-18) Avail: NTIS CSCL 06/4

Eye-scan data are recorded by a (Honeywell) remote one cubic-foot oculometer from 12 human subjects given a free-viewing task when shown projected photographic slides; 180 computer plots are prepared from the recorded scanpath data. Stimulus slides include 20 complex outdoor scenes in ten categories according to subject content; low-pass and high-pass versions of these scenes prepared by a coherent optical (He-Ne laser) spatial filtering apparatus are included in the stimulus set. Photographic prints of the stimuli are digitized and computer programs written to analyze the relative spatial frequency content of small subsections of each print. Recommended analysis of eye-scan and spatial frequency data may provide an insight into the mechanisms used by the human visual system in scanning visual scenes. GRA

N76-25769# Army Research Inst. of Environmental Medicine, Natick, Mass.
TEMPERATURE REGULATION TRAINING IN A COOLING ENVIRONMENT
R. Newman Aug. 1975 26 p refs
(AD-A019591; USARIEM-M-35-75) Avail: NTIS CSCL 05/10

Twelve young men were given biofeedback training to enable them to increase finger temperature at will. They were dressed in warm clothing, including gloves, and placed six at a time in an environmental chamber at 7C for three hours daily for eight work days. Each was to attempt six rewarmings per session. Finger temperature was presented to the subject on a multipoint recorder. Data from 554 attempts were analyzed. A training effect was not noted, but successful rewarmings were present from the start. The 12 subjects varied considerably in ability to rewarm, from 89% to 28% successes. They were divided into the most and least consistent groups and compared for temperature through the exposure time. The most consistent six ended the exposure about 6C warmer than the least consistent who, nevertheless, remained over 10C above air temperature. These performances were compared with another group wearing identical, or even much more insulative, handwear under roughly comparable conditions but without voluntary rewarming; the advantage of periodic feedback rewarming to maintain finger temperature in such conditions was obvious. GRA

N76-25770# Artech Corp., Falls Church, Va.
THE DESIGN AND FABRICATION OF A PROTOTYPE INFLATABLE HEATED CASUALTY EVACUATION UNIT Final Report, 1 Jul. 1974 - 31 Jul. 1975
Robert W. Ellis, R. William Smith, and Frank E. Swindells Sep. 1975 58 p ref
(Contract DAMD17-74-C-4129)
(AD-A019697; J7406-FR) Avail: NTIS CSCL 06/12

ARTECH CORP. has designed and fabricated a prototype of a portable, inflatable, electrically heated and thermostatically controlled casualty evacuation unit. The ARTECH prototype utilizes good insulation properties coupled with thermal energy storage materials to maintain a casualty for 2 hours at a comfortable temperature (50F or better) if a loss of power occurs. The unit can be heated with three separate power sources including 24 Vdc, 28 Vdc and 115 Vac. When the unit is deflated, it can be folded to less than 2 cubic feet for storage and weighs approximately 35 lbs. GRA

N76-25771# Edgewood Arsenal, Aberdeen Proving Ground, Md.
EFFECTS OF ESERINE UPON LIGHT SENSITIVITY AND DARK ADAPTATION Special Publication Jan. 1972 - Dec. 1973
M. S. Trussov Nov. 1975 15 p refs Transl. into ENGLISH from Oftal'mol. Zh. (USSR) v. 17, no. 6, 1962 p 366-371
(DA Proj. 1W7-62718-AD-21)
(AD-A019268; EB-SP-76005) Avail: NTIS CSCL 06/15

The author, a medical science degree candidate from the eye clinic, Khabarovsk Medical Institute, studied the effects of systemic administration of eserine upon light sensitivity and dark adaptation on 94 subjects. After injection (probably intramuscular) of eserine, the light sensitivity increased noticeably and the dark adaptation process accelerated. He explained these results in terms of the accumulation of acetylcholine in all neural synapses in the visual system: viz., retina, lateral geniculate body, and visual cortex. He emphasized that the process of visual adaptation cannot be reduced only to synthesis of rhodopsin. The maximum increase of light sensitivity, measured with a Kravkov-Vishnevsky apparatus, occurred 1.5 to 2.0 hours after injection of eserine and lasted for 6 to 12 hours. Light sensitivity accelerated the dark adaptation time as measured with the A.M. Belostotsky-Gofman adaptometer. To achieve these effects, a relatively small dose range (0.5 to 0.8 ml of a 0.1% water solution of eserine) must be used. A dosage of 0.3 ml of 0.1% solution was not sufficient to achieve the desired effect, and 1.0 ml of 0.1% solution caused undesired effects: vertigo, increased heart (beat.) and nausea. GRA

N76-25772# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF MOTOR FUNCTION AND CONTROL IN THE HUMAN NERVOUS SYSTEM M.S. Thesis
Robert Edward Dzialo Dec. 1975 50 p refs
(AD-A020098) Avail: NTIS CSCL 06/16

A theory is presented on voluntary learned and unlearned motor movement. The basic elements on motor control are presented, analyzed, and discussed. These include fundamental reflexes, gamma-muscle spindle servo mechanism, reticular system, cerebellum, and higher brain centers. The interrelations between the above elements and systems are examined in detail as a basis of the theory presented. The theory follows the transition from unlearned to learned movement and demonstrates how detailed control may be modified by the cerebellum and associated areas. GRA

N76-25773# School of Aerospace Medicine, Brooks AFB, Tex.
INTERRUPTION OF DENITROGENATION BY AIR-BREATHING Final Report, Oct. 1974 - Jul. 1975
Julian P. Cooke Dec. 1975 11 p
(AF Proj. 7164)
(AD-A020049; SAM-TR-75-45) Avail: NTIS CSCL 06/5

This study was designed to determine whether or not a proposed denitrogenation time, interrupted with a short air-breathing time and when matched with an additional denitrogenation time equal to the interruption, would protect from bends (decompression sickness) during the Shuttle program. The gas mixtures represent those obtainable with the personal breathing system. Using 17 human volunteers, the study showed that a 3-hr denitrogenation time with a 95% O2- 5% N2 breathing mixture at 14.5 psia (745 torr) would protect most humans from bends during a 2-hr exposure at a suit pressure of 3.8 psia (197 torr) while breathing 92% O 2 8% N2. A 5-or 10-min

interruptive period with air-breathing after 1, 2, or 3 hr of denitrogenation at 14.5 psia, however, even when followed by an additional denitrogenation period equal to the interruptive period, will result in an occasional case of bends in some subjects during the 2-hr exposure at 3.8 psia. The first symptoms of bends can be expected after about 40 min. Testing is suggested with a 95% O 2- 5% N2 gas mixture for both exposures, along with longer make-up times of denitrogenation. Author (GRA)

N76-25774# Army Research Inst. of Environmental Medicine, Natick, Mass.

EFFECTS OF PRIOR HYPOXIA EXPOSURE ON VISUAL TARGET DETECTION DURING LATER MORE SEVERE HYPOXIA, AND NOTE ON THE RELATIONSHIP BETWEEN INTROVERSION-EXTRAVERSION, DEPENDENCE, AND ACCURACY OF VISUAL TARGET DETECTION

John L. Kobrick and Bernard J. Fine. Sep. 1975. 37 p. refs.
(DA Proj. 3A0-62110-A-827)
(AD-A019250; USARIEM-M-9-76) Avail: NTIS CSCL 06/19

Three groups of 15 subjects each were exposed to 3 different combinations of intermediate (staging) altitudes and exposure times, and were then tested for visual target detection capability at a final altitude of 4300 meters. All groups with staging exposure performed better at altitude and had fewer symptoms of acute mountain sickness than a fourth group which went directly 4300 meters altitude from sea level. The data showed that task factors both viewing distance and degree of peripheral target placement significantly influenced detection time within all groups regardless of altitude exposure variations. Field-dependence-independence (Hidden Shapes Test) and extraversion-introversion (Maudsley Personality Inventory) were found to be separately and jointly related to accuracy of target detection. The major effects were attributable to the notably poorer performance of Ss characterized as field-dependent extraverts. GRA

N76-25775# Army Research Inst. of Environmental Medicine, Natick, Mass.

ROLE OF PHYSICAL CONDITION IN HEAT ACCLIMATIZATION, DECAY, AND REINDUCTION

K. B. Pandolf, R. L. Burse, and R. F. Goldman. Aug. 1975. 25 p. refs.
(DA Proj. 3A7-62758-A-827)
(AD-A019588; USARIEM-M-4-76) Avail: NTIS CSCL 06/19

The study provides information about (1) the decay of heat acclimatization over periods of 3, 6, 12 and 18 days assessed by an evaluation of the residual retention, (2) the time necessary for reacclimatization and (3) the relative importance of physical condition in these processes. GRA

N76-25776# Army Research Inst. of Environmental Medicine, Natick, Mass.

SUSTAINED VENOCONSTRICTION IN MAN SUPPLEMENTED WITH CO2 AT HIGH ALTITUDE

Julio C. Cruz, Robert F. Grover, John T. Reeves, John T. Maher, and Allen Cymerman. May 1975. 27 p. refs.
(DA Proj. 3A7-62758-A-827)
(AD-A019119; USARIEM-M-33-75) Avail: NTIS CSCL 06/19

Five male subjects were exposed to simulated high altitude (4000-4400 m) with supplemental CO2 in a hypobaric chamber for four days. Similar alveolar O2 tensions were obtained in four control subjects exposed to an altitude of 3500-4100 m without CO2. Thus both groups had comparable hypoxic levels, but one was nearly normocapnic and the other became spontaneously hypocapnic. A water-filled plethysmograph was used to determine forearm flow and venous compliance. Systemic blood pressure was measured with the cuff procedure. Catecholamines were measured in 24-hour urine collections. Venous compliance fell in both groups and was less ($p < 0.01$) than control values after 2, 48 and 72 h at high altitude. No significant difference was observed between the groups. Forearm flow and resistance were unaltered at altitude in the group with CO2 supplementation while forearm flow decreased and resistance increased in the hypocapnic group at 72 h of exposure. Urinary catecholamines increased in the group with CO2 and remained unaltered in the hypocapnic group. It is concluded that hypoxia is responsible for decreasing venous compliance, and hypocapnia for increasing resistance and decreasing flow. Group differences observed in urinary catecholamines may be explained by differences in arterial pH. GRA

N76-25777# Army Research Inst. of Environmental Medicine, Natick, Mass.

PERCEIVED EXERTION OF ABSOLUTE WORK DURING A MILITARY PHYSICAL TRAINING PROGRAM

John F. Patton, William P. Morgan, and James A. Vogel. 22 Aug. 1975. 19 p. refs.
(DA Proj. 3A7-62758-A-827)
(AD-A019118; USARIEM-M-6-76) Avail: NTIS CSCL 06/19

The purpose of this study was to compare the rating of perceived exertion (RPE) and heart rate (HR) in two groups of 40 military personnel who differed in their level of fitness as determined by VO2 max. At an initial testing period (T1), Group I represented a sample of personnel not participating in a training program while Group II had engaged in an endurance program (2-4 mile run/day) for 5 months. Six months, later (T2), Groups I and II were retested after having participated in the program for 6-11 months respectively. RPE and HR were measured at the end of each min. of a 6-min. run at an absolute workloadof 6 mph, 0% grade on the treadmill. At T1, Group II had a significantly lower HR at each min of work but no difference existed in RPE between groups at any time during the run. At T2, both groups showed a significant decrease in HR and RPE during each min when compared longitudinally. The data suggest that the perception of the intensity of absolute work does not differ in groups differing in their level of fitness when studied cross-sectionally. However, significant reductions in perceived exertion occur following physical training. Author (GRA)

N76-25778# Edgewood Arsenal, Aberdeen Proving Ground, Md.

A COMPUTER PROGRAM TO PREDICT ENERGY COST, RECTAL TEMPERATURE, AND HEART RATE RESPONSE TO WORK, CLOTHING, AND ENVIRONMENT Special Publication, Feb. - May 1975

Howard M. Berlin, Leander Stroschein, and Ralph F. Goldman. Nov. 1975. 31 p. refs.
(DA Proj. 1W7-62710-A-095)
(AD-A020112; ED-SP-75011) Avail: NTIS CSCL 06/19

As a result of many years of thermal stress studies, a computer program was developed at USARIEM, Natick, Massachusetts, to predict rectal temperature and heart rate response to work, environment, and clothing. The report defines the mathematical basis of the program and presents a brief guide for its use with the HP9810A programmable calculator. GRA

N76-25779# Army Research Inst. of Environmental Medicine, Natick, Mass.

THERMAL COMFORT FACTORS, CONCEPTS AND DEFINITIONS

R. F. Goldman. Aug. 1975. 6 p.
(DA Proj. 3A7-62758-A-827)
(AD-A019589; USARIEM-M-5-76) Avail: NTIS CSCL 05/5

While air temperature, ambient vapor pressure, air motion and solar load, if any, are critical factors of climate, clothing is an essential consideration in the microclimate of an individual. However, it has been ignored by most biometeorologists and physiologists, while clothing researchers have concentrated on fit, weave, style, wear-life and costs. The 'clo' unit of insulation is useful for estimating the combined radiant and convective heat exchange for a resting clothed man. It represents a combination of theory and empiricism. If one can define the thermal 'clo' insulation of clothing, and how it is modified by wind, and by wearer motion, and knows the ambient air temperatures in which the clothing will be worn one can, with reasonable accuracy, estimate the actual heat loss that will occur by long wave radiation and convection; short wave (solar) radiation, although more complex, can also be estimated. GRA

N76-25780# Bernard Baruch Coll., New York. Dept. of Psychology.
EVOKED CORTICAL POTENTIALS AND INFORMATION PROCESSING Annual Report, 1 Jan. - 31 Dec. 1975
John L. Andreassi, J. J. DeSimone, B. W. Mellers, J. A. Gallichio, and M. A. Friend. 31 Dec. 1975. 86 p. refs
(Contract N00014-72-A-0406-0006; NR Proj. 201-053)
(AD-A019199; AR-3) Avail: NTIS CSCL 05/10

This is the third annual report to originate from the Psychophysiology Laboratory of the Psychology Department of Baruch College. The research completed over the past year has included a number of studies concerned with evoked cortical potential correlates of stimulus processing in humans. GRA

N76-25781# Manned Systems Sciences, Inc., Northridge, Calif.
ERGONOMIC MODELS OF HUMAN PERFORMANCE: SOURCE MATERIALS FOR THE ANALYST
William T. Roe and Dorothy L. Finley. Aug. 1975. 107 p. refs
(Contract N00014-74-C-0324; NR Proj. 364-090; NR Proj. 274-244)
(AD-A020086) Avail: NTIS CSCL 05/5

The materials in this report are organized so as to do three things: (1) introduce the ergonomics view to the analyst who is without background in the behavioral and biological sciences, 2) make the spectrum of ergonomics models reviewable by the sophisticated analyst, and (3) make it apparent that ergonomics concentrates on certain mechanical aspects of the human operator and that even these limited aspects can be very complex. The report contains (1) discussion materials to introduce the viewpoints and approaches of the ergonomist, (2) a presentation of selected samples of ergonomics models, and (3) references to application examples and to other sources of information. GRA

N76-25782# Advisory Group for Aerospace Research and Development, Paris (France).
HIGHER MENTAL FUNCTIONING IN OPERATIONAL ENVIRONMENTS
Bryce O. Hartman, ed. (School of Aerospace Med., Brooks AFB, Tex.) Apr. 1976. 82 p. refs. Presented at Aerospace Med. Panel Specialists Meeting, Ankara, 21 Oct. 1975
(AGARD-CP-181; ISBN-92-835-1216-2) Copyright. Avail: NTIS HC $5.00

Psychophysiology of flight stress and human factors engineering for military aviation systems is elaborated.

N76-25783 Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
DEFINITION AND MEASUREMENT OF PERCEPTUAL AND MENTAL WORKLOAD IN AIRCREWS AND OPERATORS OF AIR FORCE WEAPON SYSTEMS, A STATUS REPORT
Siegfried J. Gerathewohl. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 7 p. refs

The determination of pilot and aircrew workload using psychological, physiological, and operational criteria has yielded valuable results. Methods used in civil aviation can be applied with appropriate modifications to military problems. However, workload measurements associated with highly complex and demanding conditions are still difficult. Data are not available from actual combat missions. The results obtained by simulation are promising and may be improved by the standardization of methods and the application of statistical approaches and mathematical models. Author

N76-25784 School of Aerospace Medicine, Brooks AFB, Tex.
THE CORRELATIONAL STRUCTURE OF TRADITIONAL TASK MEASURES AND ENGINEERING ANALOGUES OF PERFORMANCE IN THE COGNITIVE DOMAIN
Richard C. McNee, Richard A. Albanese, William G. Jackson, William F. Storm, and Bryce O. Hartman. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 6 p. refs

Standard performance measures from a traditional battery of tasks (the Neptune battery) were compared with simulated antiaircraft gunnery activities under several configurations. These measures were found to correlate only to a moderate degree, with the highest canonical correlation between the two sets being .72. Preliminary modeling of the subject reactions on the simulation, a compensatory tracking task, has been accomplished using control theory methods. A tentative conclusion from this work is that the transfer functions associated with random inputs are reasonable to use for this compensatory tracking task, which involves both deterministic and random inputs. Author

N76-25785 Milan Univ. (Italy).
A STUDY OF BEHAVIOUR DURING A TRIAL OF VIGILANCE IN NON-PILOTING PERSONNEL
Ferdinando Monesi and Francesco Ravaccia. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 6 p. refs

Subjects highly experienced in air traffic assessment and decision making tasks underwent a performance trial involving visual vigilance in a simulated operative environment. Data were collected by administering self rating scales and recording both reaction times and brain potentials. Statistical analysis of data was performed with parametric and non parametric tests. All types of approach proved to be of value in the assessment of performance, although the greater utility of computerized neurophysiological evaluation must be emphasized for an advance in methodology. Author

N76-25786 Pacific Missile Test Center, Point Mugu, Calif.
SOME PRACTICAL CONSIDERATIONS FOR PERFORMANCE TESTING IN EXOTIC ENVIRONMENTS
Robert S. Kennedy and Ronald A. Bruns. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 6 p. refs

Correlations and normative data for six different versions of an auditory vigilance task are presented for approximately 100 males. In addition, other findings about effects on performances of: practice, distractions, threat stress, and aircraft turbulence are discussed. Instructions for apparatus construction, scoring, and administration are reported. Author

N76-25787 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
AIR OPERATIONS AND CIRCADIAN PERFORMANCE RHYTHMS
K. E. Klein, H. M. Wegmann, G. Athanassenas, H. Hohlweck, and P. Kuklinski. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 12 p. refs

(Contract F33615-70-C-1598)

Experimental results and pertinent data from literature on circadian behavioral rhythms and their modifications through various factors are reviewed. Considered are operations of aircrews round the clock and on transmeridian routes; some possibilities of appropriate scheduling are discussed. Author

N76-25788 School of Aerospace Medicine, Brooks AFB, Tex.
THE HUMAN AS AN ADAPTIVE CONTROLLER
Richard A. Albanese, Richard C. McNee, Edward J. Engelken, Peter H. Henry, and Bryce O. Hartman. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 8 p. refs

During flight, aircrew members often function as subsystems in feedback control loops. In particular, visual tracking tasks have been studied for many years. For these tasks, it has been observed that the human alters his control actions when the device to be controlled, or when the bandwidth of the signal to be tracked, is changed. Thus, the human operator appears to be an adaptive controller. This article reviews the adaptive nature of man's control function using previously published data, and introduces information theory metrics which show a regularity in these data. Also, new data obtained from twelve subjects flying simulator while under the influence of orally administered 190 proof ethyl alcohol (0.0, 0.3, 0.6, and 0.9 gms/kg body weight) are presented. These results are related to previous studies, using both control and information theory metrics. Author

N76-25789 Civil Aeromedical Inst., Oklahoma City, Okla. Aeronautical Center.
ASSESSMENT OF PERCEPTUAL AND MENTAL PERFORMANCE IN CIVIL AVIATION PERSONNEL
Siegfried J. Gerathewohl (FAA, Washington, D. C.), W. Dean Chiles, and Richard I. Thackray. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 4 p. refs

A series of experiments were conducted in order to study functions of relevance to aircrew, pilot, and ATC performance. They concerned the assessment of mental functions and complex performance on single operators and five man crews while monitoring static and dynamic processes, of perceptual motor tracking ability, as well as group problem solving. Operator proficiency was measured at various levels of demand induced by the simultaneous performance of different combinations of tasks, requiring the exercise of psychological and mental processes. It was found that multiple task performance varied significantly as a function of information input and group interaction. Substantial correlations were obtained between perceptual motor type problem solving and mental ability tests. Moreover, the results obtained from two tracking tasks suggest that a central process exerts a regulatory influence on a variety of physiological variables during increased attention demand and, furthermore, a correlation exists between the ability to sustain attention and personality characteristics of the operator. Author

N76-25790 Surrey Univ., Guildford (England).
EMOTIONAL STRESS AND FLYING EFFICIENCY
L. R. C. Haward. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 5 p. refs

A comparative study of the effects of emotional and intellectual stress upon flying performance is described. Ten pilots with self confessed emotional problems, but certified medically fit to fly were matched approximately for age and flying experience with ten pilots confessing to no emotional problems. Emotional stress was induced by a clinical abreactive technique and measured in terms of psychophysiological concomitants. Intellectual stress was induced by the PASAT technique which is an automated numerical task designed to produce mental overload. Flying skill was measured in the presence and absence of both types of stress separately by means of a crossover design. The results show significant differences in flying performance between the two groups and between the two types of stress. It is demonstrated that intellectual stress produces impaired flying skill which is predictable both in degree and duration, whereas emotional stress produces substantially more severe but fluctuating degrees of impairment of unpredictable duration. The use of a psychometric technique using personal keywords and physiological monitoring clearly differentiates the two groups of pilots and indicates the origins of emotional stress. Its possible use for screening aircraft captains before important missions is examined. Author

N76-25791 Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
A CONCEPTUAL MODEL FOR OPERATIONAL STRESS
William A. LePage, Robert F. Thatcher, and Peter J. Dean. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 5 p. refs

In the Canadian Forces, as in the NATO Air Forces, there are a variety of stressful operations. In discussing these complex stress situations with operational commanders, it was found beneficial to utilize a conceptual model to describe the circumstances. This model is described and discussed. Author

N76-25792 Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
SECONDARY TASK ASSESSMENT OF COGNITIVE WORKLOAD IN ALTERNATIVE COCKPIT CONFIGURATIONS
Robert D. ODonnell. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 4 p. refs

(AMRL-TR-75-49)

New developments in cockpit design introduce significantly greater cognitive demand on the crew member. In a series of pilot studies, traditional secondary task reserve capacity concepts were modified to be used at sub-maximal levels of workload. A primary flight simulation was performed simultaneously with the item recognition task. This task was chosen because the intercept and slope functions of the memory load/reaction time function appear to independently assess cognitive and sensory motor workload. The secondary task shows reliable and consistent changes with variations in workload, and appears promising as an objective measure of higher mental functions. Auditory and visual versions have been constructed, and further validation studies are being carried out. Author

N76-25793 School of Aerospace Medicine, Brooks AFB, Tex.
THE EFFECTS OF TWO STRESSORS ON TRADITIONAL AND ENGINEERING ANALOGUES OF COGNITIVE FUNCTIONING
William F. Storm, Richard C. McNee, Richard A. Albanese, and Bryce O. Hartman. *In* AGARD Higher Mental Functioning in Operational Environments. Apr. 1976. 12 p. refs

The sensitivities to stress of traditional psychometric measures and human operator technology engineering parameters were compared in two experiments. In the first study, the effects of mild (8,000 ft) and moderate (15,000 ft) hypoxia were assessed. In the second study, standby alert duty was simulated. Systematic comparison was made between performance following sudden awakening and performance following enforced wakefulness. A battery of tasks emphasizing cognitive processes generated traditional performance measures. Psychomotor functions involving vigilance, problem solving, short term memory, and compensatory tracking were exercised. In addition, a two dimensional tracking task provided traditional task measures and human operator engineering parameters. The properties of the task were systematically varied and models developed for each condition. Both the traditional task measures and the HOT model parameters were analyzed for changes suggestive of alterations in cognitive functioning. The data suggest significant influences of both stressors on cognitive functioning. Conventional performance measures from the HOT task were more sensitive to the stress effects than the traditional task battery. Author

N76-25794*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
A SCIENTIFIC DIALOG BETWEEN THE LEADING SPACE POWERS
R. Z. Sagdeyev and G. M. Frank. Washington NASA Jun. 1976. 12 p. refs Transl. into ENGLISH from Priroda (USSR), no. 2, Feb. 1976. p 147-151
(Contract NASw-2789)
(NASA-TT-F-15463) Avail: NTIS HC $3.50 CSCL 05H

A three volume book, 'Principles of Space Biology and Medicine', was published in both English and Russian. The three volumes contain chapters written by American and Soviet specialists. The first volume is devoted to space as a medium of habitation. The second volume deals with the effects of space flight on practical questions of life and health support in manned space ships. The book concludes with a description of the potentials for manned space flights. Author

N76-25795*# Vought Corp., Dallas, Tex. Systems Div.
DEVELOPMENT OF A REFRIGERATION SYSTEM FOR LUNAR SURFACE AND SPACECRAFT APPLICATIONS Final Report
R. J. Copeland. 9 Apr. 1976. 42 p. refs
(Contract NAS9-9912)
(NASA-CR-147761, T122-RP-046) Avail: NTIS HC $4.00 CSCL 06K

An evaluation of refrigeration devices suitable for potential lunar surface and spacecraft applications was performed. The following conclusions were reached: (1) the vapor compression system is the best overall refrigeration system for lunar surface and spacecraft applications and the single phase radiator system is generally preferred for earth orbit applications, (2) the vapor

compression cycle may have some application for simultaneous heating and cooling, (3) a Stirling cycle refrigerator was selected for the manned cabin of the space shuttle, and (4) significant increases in payload heat rejection can be obtained by a kit vapor compression refrigerator added to the shuttle R-21 loop. The following recommendations were made: (1) a Stirling cycle refrigerator may be used for food freezer and biomedical sample storage, (2) the best system for a food freezer/experiments compartment for an earth orbit space station has not been determined, (3) a deployed radiator system can be designed for large heat loads in earth orbit. Y.J.A.

N76-25796*# Nebraska Univ., Lincoln.
HEALTH PROTECTION AND FOOD PRESERVATION BY GAMMA IRRADIATION Final Report, May 1976
May 1976 33 p refs
(Contract NAS9-11045)
(NASA-CR-147779) Avail: NTIS HC $4.00 CSCL 06R

Results of several major studies on food systems for space missions beginning with Apollo 12 through Apollo-Soyuz and investigations of the application of irradiation to food for manned space flight are reported. The study of flight food systems involved the application of radurization (pasteurizing levels) doses of gamma irradiation to flour and bread supplied by Pepperidge Farms in advance of the missions. All flights from Apollo 12 through 17 carried irradiated fresh bread. On Apollo 17, cooperation with Natick Laboratories permitted the introduction of a ham sandwich using irradiated bread and irradiated sterile ham. Investigations centered on irradiated bread were conducted during the course of these missions. Studies were applied to the concept of improving fresh bread from the point of view of mold inhibition. The studies considered how irradiation could best be applied at what levels and on a variety of bread types. Throughout the studies of the application of gamma irradiation the emphasis was placed upon using low levels of irradiation in the pasteurizing or radurizing doses--under a Megarad. The primary goal was to determine if a public health benefit could be demonstrated using radurization along with food preservation and food quality improvements. The public health benefit would be parallel to that of pasteurization of milk as a concept. Publications are included providing the details of these observations, one dealing with the flour characteristics and the other dealing with the influence on fresh bread types. These demonstrate the major findings noted during the period of the studies examining bread. Author

N76-25797*# Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
MECHANISMS OF DETERIORATION OF NUTRIENTS Annual Report, 13 Mar. 1975 - 13 Mar. 1976
Marcus Karel and James M. Flink 13 Mar. 1976 197 p refs
(Contract NAS9-12485)
(NASA-CR-147780) Avail: NTIS HC $7.50 CSCL 06H

Methods which produce freeze dried foods of improved quality were examined with emphasis on storage stability. Specific topics discussed include: microstructure of freeze dried systems; investigation of structural changes in freeze dried systems; artificial food matrices; osmotic preconcentration to yield improved quality freeze dried fruits; and storage stability of osmotically preconcentrated freeze dried fruits. J.M.S.

N76-25798# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF THE EFFECT OF PERIPHERAL VISION MOTION CUES ON ROLL AXIS TRACKING M.S. Thesis
Don R. Price Dec. 1975 112 p refs
(AD-A019852; GE/EE/75-37) Avail: NTIS CSCL 05/10

Six subjects were used as controllers for an experiment in which compensatory roll axis tracking was performed with and without the presence of peripheral vision motion cues. Two different controlled plant dynamics were simulated on an analog computer. Control was commanded via a force stick located in a stationary fighter aircraft cockpit mockup. Controlled plant roll rate, in the form of vertically moving black and white grid lines, was displayed on two 21-inch television screens positioned on either side of the cockpit. RMS error scores and time histories were recorded for individual runs. Frequency domain analysis and data averaging techniques were used to study and compare subject performance. GRA

N76-25799# Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
EVALUATION OF AN ADVANCED AUTOMOTIVE RESTRAINT SYSTEM USING HUMAN SUBJECTS Final Report
Edwin Hendler, Joseph ORourke, Leon Domzalski, Mark Katzepf, and Marvin Schulman 5 Jun. 1975 101 p refs
(Contract DOT-HS-063-1-0811)
(AD-A012469; NADC-75067-40) Avail: NTIS CSCL 13/12

Safety administration NHTSA, sponsored a research program at the Naval Air Development Center NAVAIRDEVCEN, utilizing its horizontal accelerator facility to conduct dynamic tests on advanced passive seat belt restraint systems using both anthropometric dummies and human volunteers. During this phase, two subjects succeeded in tolerating exposures to simulated car crashes involving velocity changes of over 30 MPH and peak accelerations of over 21 G, when using a conventionally configured restraint system of advanced design, and applying technics of body posturing and muscular tensing. When injuries caused by motions of the head and neck are avoided, a three-point belt restraint system of advanced design is capable of providing considerable protection to the wearer, up to car crash levels of practical significance. GRA

N76-25800*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
EXOBIOLOGY AND THE ORIGIN OF LIFE Annual Status Report, 1 Jul. 1975 - 30 Jun. 1976
Carl Sagan and Bishun N. Khare May 1976 12 p
(Grant NGR-33-010-101)
(NASA-CR-148177; CRSR-637) Avail: NTIS HC $3.50 CSCL 03B

Abstracts on planetary studies and the search for extraterrestrial life are presented. Studies of the Jovian atmosphere were conducted. An assessment of the prospects for life on Mars is presented. And, the means of contacting extraterrestrial civilizations is discussed. A.S.K.

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